

# *Interactive Multimedia Educational Games*

## *FunMaths*

Perpustakaan SKTM

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# ABSTRACT JUDGMENTS

Over the past two decades electronic games have become ingrained in our culture. Children's fixation with these games initially alarmed parents and educators, but educational researchers soon questioned whether the motivation to play could be tapped and harnessed for educational purposes. A number of educational electronic games have been developed and their success has been mixed.

Thus, I have chosen my thesis title as "Interactive Multimedia Educational Game" which we have name it as KidsHeaven and I will develop an educational game for Mathematic which I name it as FunMaths while my partner will be doing about Science, FunSciences. This game was created in CD-ROM based and will be suitable for students in primary school especially age between 7 and 12, parents and teachers and will only include questions based on Mathematic operations for not more than three digits. User will be able to choose the level of difficulties. One of the objectives of this game is to help teachers in teaching Mathematics in English and to help the students to understand more about the subject.

The system implements the concept of multimedia, which integrates text, graphics, animations and audio into the game display to make the game more attractive especially for the kids. Macromedia Authorware 6, Macromedia Flash MX, Adobe Photoshop 6.0 and some other tools was used to develop the interactive game.

Finally, I hope the "Multimedia Interactive Educational Game" can serve to enable players enjoy themselves throughout the playing and learning process, and to achieve the objective specified before the system is develop.

for their support and understanding for the past almost one year.

Finally, I would like to wish everyone feel good and may all be well and happy. Thanks to everyone.

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# CHAPTER 1: Introduction

## 1.1 Project Overview

It is no secret that motivation is one of the keys to education. Thus, it is a logical step to try to take advantage of the essentially motivating nature of electronic games by using this medium for educational purposes rather than simply for pure entertainment. The idea of producing educational games is certainly not new; it was one step behind the advent of electronic games themselves (Malone, 1981, 1982; Gentner, 1990; Nawrocki and Winner, 1983; Lepper and Chabay, 1985; Reynolds and Martin, 1988). Educational games, sometimes called "edutainment" (Lepper and Chabay, 1985), represent the fastest-growing type of software (Consumer Reports, 1995).

Beginning with the natural and pleasurable inclination to count, children develop the fundamentals for number manipulations. Not every child will come across the mysteries of mathematics without frustration, dissatisfaction, disappointment or difficulty. Although "number sense" is intrinsic to humans, arithmetic and mathematics are acquired through this sense. Thus, I have planned to develop a Multimedia Interactive Educational Game using the combination of multimedia element such as texts, graphics, animations and sound, so that it will attract student's attention and also interest in mathematics. The game will be suitable for primary school student age between 9 and 12 and teachers. To provide the students the opportunity to involve in self-learning according to their own ability I will develop the game into sub-module according to student's level. It can also be use to test student's reaction in answering the questions provided.



Other than that, I will also provide user with User's Help to enable users to refer to when they need any help.

## 1.2 Project Objectives

Below are the objectives of my thesis project:

- to assist the students to understand more and to learn on their own rate independently or efficiently and up to their full potential with the help of this educational game.
- to help teachers in applying an interesting way of teaching Mathematics in English.
- to implant the latest technology.
- to provide students with easy and interactive way of learning and understanding the subject.
- to help students to evaluate their skills and knowledge in Mathematic.
- encourage students to learn Mathematics other that depends on notes and books.
- to reveal to the student the benefits of using the educational game in learning Mathematics.
- solving the problems that occur in normal and traditional learning system

## 1.3 Motivation

1.4.1 Project The reason I develop this game is to change most people's perception towards the process of learning Mathematics especially those who is weak in this subject. Other than that, I also wish that through this game, more students will understand the importance of the subject.

Thirdly, the older generation such as parent age, always has a negative view towards computer games because they take playing computer games as an activity that causes the waste of time, energy and money, and will cause their children to get addicted to it and spend less time in their revision or studies. Thus, I would like to eradicate this wrong perception by set up this Interactive Multimedia Educational Game (KidsHeaven).

Computer nowadays has become an essential or crucial part of the world and it has greatly influences the field of entertainment and education. Thus, the educational sector can no longer neglect the computer and multimedia technologies.

## 1.4 Project Scopes and Target User

### 1.4.1 Project Scopes

- to set an effective and helpful learning tool for children
- give education a step further in learning and teaching for primary school in order to prepare them for greater challenge in school.
- suitable for children's intellectual development
- my project will be emphasize in:
  - combination of multimedia element such as texts, graphics, animation and sound, so that it will attract students attention and also interest
  - free to choose module or level and play according to the module or level
  - suitable for parents, teachers and whoever in helping their students or children in learning mathematics with fun.

### 1.4.2 Target Users

- My project will be suitable for:
  - Kids age between 7 and 12
  - Teachers
  - and other users



## 1.5 Goals Planning

My goal of preparing this educational game is to increase the number of students who have the interest in Mathematic because it was one of the subjects that plays an important role in our daily life and it is full of fun and challenging. Besides I also wish that more Malaysians will get involve in scientific and mathematics research area.

## 1.6 Limitation and Constraints

Due to time limitation and wide range of coverage, this project will have some limitation. This project will only include operations such as addition, subtraction, multiplication and division for digits that are less than and include three digits.

## 1.7 Expected Outcome



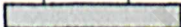



After research and review on current teaching and learning style, electronic educational games and also some other research related to this project which I will explain in the following chapter, this project will have the following expected outcome:

- The interface will include multimedia or animation application which will attract children's attention and interest.
- Enable user to choose any modules from the games according to their ability and interest.
- Helping in motivating users in learning Mathematics.

## 1.8 Project Planning

The table below is the project schedule for the whole project included phase I and phase II.

Table 1.1 : Project Schedule

Phase	June	July	Aug	Sept	Oct	Nov	Dec
Requirement Analysis							
Design							
Development and Coding							
Testing							
Maintenance							
Documentation							

# CHAPTER 2: Literature Review

## 2.1 Multimedia

### 2.1.1 What is Multimedia?

Computers which had come into existence about three decades ago were formerly support only the computations related to research. As time progressed and with the technological advances, the computers became powerful contrivances and now it had become an important part of our daily life.

The modern computer system is a multimedia machine and it is capable of combining two or more conventional forms of informational media in a single electronic document. This technology enable user to interact, explore and learn even more because it can help in express and combine various forms of information using computer. Thus, the computer had become a medium for knowledge and not just only a tool that stores, distributes, and displays information.

Multimedia can be define as the seamless combination of text, sound, images of all kinds and control software within a single digital information environment. This definition applies to interactive media productions for distribution both online, such as Web pages, and offline, such as kiosks and CD-ROM. Multimedia has the ability to pretend to be many things. In designing an application, it provide the freedom to use disparate media types and technique that it can be challenge to understand which ones are relevant for a particular type of project. With animation, sound and pictures, it can



help in attract viewer to the screen and at the same time, make the most tedious of help screens interesting.

A typical multimedia application is characterized by the following features:

- the different media it makes use of
- the use of digital technology
- the interaction it demands of the user
- and the combination of text, sound, images and data into seamless applications

In general, by using multimedia it can produce applications that are:

- **Efficient** - it can replace information that is only readable with information that can be seen and hear, such as a video clip.
- **Direct** - it can be use to deliver information using the best medium, such as a language-teaching application that plays a native speaker's voice to demonstrate pronunciation.
- **Interactive** - It makes constructing genuine and multilevel user interaction with sounds and pictures much easier than using plain text only.

### 2.1.2 What are the elements of Multimedia?

There are six major components which make up a typical multimedia program:

#### 1. Text

This is the base of most application and it was also the most common media type. Text was the standard mode of communication in the computer world and can be typed in, scanned with OCR, speech and handwriting. To emphasize specific points, user can use different styles, fonts and colors.

#### 2. Images

Seeing or looking at a picture of an object has more impact than merely reading about it and it was for sure much more common on the web and generally in multimedia too. The examples include computer-generated artwork, conventional artwork, photographs or captured video frames. It can be photographic or drawn images and it can be scanned, captured with a digital camera or formed using an image editing tools or package.

#### 3. Movies

When user want to present information which is normally out of the scope of the ordinary or normal classroom, such as medical operations or archaeological excavations, movies will be use. It was the weakest element of current multimedia systems, particularly on the Web.

Sometimes it can be replaced with a combination of audio and stills and can be "digitized" from tape or a regular camera using special devices, or captured using a unique computer camera.

The combination of all the above aspects can help in producing a seamless

#### 4. Animation

Animations can be used to render a procedure which are more accurately than a movie. For example blurred objects within a movie can be represented more clearly. It is very effective at illustrating a task that takes place over time and can be created in a program like Flash or any animated GIF editor, or captured from screen actions.

convey ideas and provide the experience of learning and doing in a

#### 5. Sound

program is designed. It can be interactive, guiding and will help

Sound can be used in some strategic parts of the program or when emphasizing certain points of a movie. This may include speech, audio effects, ambient sound and music. Sound is a potentially powerful and useful media type and often overlooked in favor of video, but audio is a more mature technology on the web. It was good synchronous point-to-point communication and can be recorded directly into computer or can be recorded directly into computer or "ripped" off a CD.

more of instruction. There will be also a high level of

interaction between user and the computer. Normally most of packages

#### 6. User Control

expect students to make choices about what they would like to do next and

the app

To prevent boredom, it will be better if there is some level of user control that can provide students with the option to leave certain parts

pages



of the application. On-screen options should exist to enable user to visit other areas of the program or navigate around the system.

The combination of all the above aspects can help in producing a seamless application. Below are the typical examples:

- linking of animation to static in-text diagrams
- linking a video clip to a descriptive paragraph

### 2.1.3 Why use Multimedia?

Multimedia computing offers a more natural way to express and convey ideas and provide the experience of listening, seeing and doing in a computer-mediated setting. To support the learning process, a multimedia program is designed. It can be interesting, motivating, exciting and will help the students in achieving understanding in new ways and can provide exciting and fun in learning process other than helping students to understand a concept faster and easier (Brown & Bush, 1992; Toh & Ng, 1994; Rio & Kasiran, 1994; Baharuddin & Mohd, 1995 ).

The combination of the usage of sound, photographs and video enables the user to view real world situations which is impossible with the more conventional methods of instruction. There will be also a high level of interaction between user and the computer. Normally most of packages expect students to make choices about what they would like to do next and the approach in which they wish to work through the material. They are not passive but their target is for the learners to actively participate.



Multimedia application plays a very important role in Mathematic Education which includes:

1. Provide the students the opportunity to involve in self-learning according to their own ability
2. Helping the students to understand the concepts easier and faster
3. Make learning as an enjoyable and exciting process
4. Provide students with more information and knowledge
5. Assisting students to repeat their revision
6. Supports different learning styles
7. Adds interest to learning materials
8. Supports those with special needs

## 2.2 Interactive Multimedia

### 2.2.1 What is Interactive Multimedia?

The amount of the control the user has over the presentation of information was known as interactivity. "Interactive multimedia" which was also refers as multimedia that has been applied with interactivity and allows for user control.

There are three common categorization of interactive which are defines below:

1. Linear presentation

A linear presentation is where the author or developer decides the sequence and manner in which information is presented while the user only controls the pace.

## 2. Programmed branching program

A programmed branching program is a program where user has some control over the sequence of presentation by selecting from the choices which was being group in a main menu. The creator still maintains the control of deciding what to include in the choices accessible at any point in the program.

## 3. Hypermedia

In hypermedia, user is almost had the complete control over the presentation which include the control of the pace, sequence and the content of the presentation. It also provides the links that enable for random access of information.

## 2.3 Human Computer Interaction (HCI)

### 2.3.1 What is HCI?

Human Computer Interaction, or HCI, is the study, planning, and design of what happens when the user and his or her computer work together. The term human-computer interaction (HCI) which was adopted in the mid-1980s is concerned with understanding, designing, evaluating and implementing interactive computing systems for human use (Preece, 1994). HCI involves the user, the computer itself, and the ways they work together as describe below:

#### 1. The User

The user is whoever trying to get the work done through the technology. An appreciation of the way people's sensory systems (sight, hearing, touch) relay information is vital to designing a first-class product. And it is for sure that it will be better if the designs are enable to grab user's attention. It is very important to decide how to make a product attractive without distracting users from their tasks.

#### 2. The Computer

The computer are normally refers to any technology ranging from desktop computers, to large scale computer systems and even a process control system or an embedded system could be classed as the computer.



### 3. The Interaction

Although there are noticeable dissimilarity between humans and machines, but by using the HCI concepts, it tries to ensure that both of it get on with each other and work together effectively. In order to achieve a usable and reliable educational game, I have applied what I know about humans and computers, and consult with likely users throughout the design process. The reasonable balance between what can be done within the schedule and budget, and what would be ideal for the users will be one of my consideration in designing the game.

The primary theme that has emerged from HCI study is that the users come first. The system need to be developed to suit the needs of the users and usable to the user rather than need the users to familiarize themselves to the system. The theory of usability is central to HCI and refers to making the system easy to learn and simple to use. One important aspect of HCI work is to understand the context and the environment in which systems will be used.

#### 2.3.2 HCI for children

It is a very natural perception that children's needs are different from adult's needs. Establishing an understanding of HCI issues that are specific to children is a neglected area of HCI research. There is without a doubt far more research into designing for adults. One area in the literature that covers learners in general is the area that looks at the needs of the new user versus the skilled user. Although not all children are novices, it is perhaps safe to assume that some children are novices and thus this literature may be



relevant. I will thus cover the areas of beginner vs. experienced users as well as specific issues in child-centered HCI.

### 2.3.2.1 Child-Centered Design

One of the differences between adults and children is the mental models that they form. Mental models are formed by users in order to help in guiding them through attempts to carry out tasks and correct errors while using computer software.

The first study done by Brown and Schneider (1992) in which a direct manipulation interface was compared to a conversational computer interface using elementary school students grades three through six. The children were given basic arithmetic problems. It was found that the direct manipulation interface was more comfortable and enhanced the speed of completing the basic arithmetic tasks. Informal observations showed that students experienced more difficulty and frustration with the conversational computer interface (Brown and Schneider, 1992).

A second study conducted by Inkpen *et al.* (preprint) investigated children's ability to perform a given task using two different interaction styles, namely, drag-and-drop and point-and-click. Results showed that children have more difficulty operating the drag-and-drop type of interaction than the point-and-click interaction.

### 2.3.2.2 Applying HCI for children to Educational Electronic Game Design

When designing a game, there are several things that should be kept in mind such as regarding the use of color, highlighting, detailed help explanations, and default values. Using sounds with appropriate affordances is also useful. The usage of sounds that naturally represent an action and that are recognizable by children could decrease children's confusion in games. Determining appropriate icons is also important. Buttons with icons are often found in games and these icons should be meaningful to children. Children prefer direct manipulation to dialogue and so, whenever possible, games should opt for direct manipulation.

## 2.4 Electronic Educational Game

### 2.4.1 Introduction

Educational games, sometimes called as “edutainment” (Lepper and Chabay, 1985), represent the fastest-growing type of software (Consumer Reports, 1995). Success is a broad term and could be assessed or measured in various ways with respect to educational electronic games. As a result, there are often very sweeping statements assessing the success of educational games without providing grounded reasoning, scientific or otherwise. These statements generally show that the success has been mediocre. For example, Brody (1993) stated that “the marriage of education and video-game-like entertainment has produced some not-very-educational games and some not-very-entertaining learning activities”.

A game will be considered successful, if it was at least has the effectiveness as traditional classroom education. This threshold for success,

2.4.2 however, may be unsuitable or inappropriate. It certainly is appropriate if games are to replace traditional classroom teaching, but if games were to be used as a supplement to classroom education, then the threshold would be too high. Several games could perhaps act as a “stand-alone teacher” for a particular subject area and a particular grade level. Students using the game may have the chance to learn the similar kinds of information as students using only a textbook. Some other games, however, while containing educational content, primarily serve as motivators that are not meant to be used in a stand-alone manner.

In addition, children may be willing to play educational games outside of school hours in lieu of watching television or playing non-educational games. In this case isn't it sufficient that these games have some educational value even if they don't meet the above threshold? It is most likely the case that the threshold has been chosen because it is the most solid comparison with educational value that can be made easily.

According to Butler (1998) when games are used:

1. students generally acquire at least equal knowledge and intellectual skills as they would in other learning situations,
2. information is learned faster than in other methodologies although the amount learned is not significantly greater than with other methods,
3. students of low academic ability often improve their academic performance because of greater interest,
4. problem solving ability increases,



## 2.4.2 Motivation : The Appeal Of Educational Game

Walker de Felix and Johnson (1993) suggest that it is the structure of video games that make them captivating, more so than their specific content. They include the following characteristics of structure, which are dynamic visuals, interaction, presence of a goal and rule-governed. While Nawrocki and Winner (1983) suggest that the key to motivation is winning while remaining challenged.

Malone defines the motivation to play electronic games as an intrinsic motivation. An activity is intrinsically motivating if people engage in it for their personal sake and not to obtain any external reward such as money or status. He also found that the challenge, fantasy, curiosity and control were the intrinsic motivations for playing.

According to Malone (1981), the games that is challenging must be able to provide goals that the players are uncertain of attaining. Other than the goals should be personally significant, they also should be obvious or easily generated. The game should also offers performance feedback on how close the user is to reach the goal. The doubt of reaching a goal can be reached in a number of ways. An outcome can be made uncertain through the use of variable levels of complicatedness that are determined automatically, selected by the player, or determined by an opponent's skill. Uncertainty can also be introduced through hidden information and randomness.

Malone's heuristic for intrinsically motivating games, can be achieved by providing an optimal level of informational complexity. This means that the atmosphere or environment should not be either too complicated or too simple with respect to the user's existing knowledge. Malone says that they



2.4.3 should be new and surprising but not entirely incomprehensible. Ways to achieve this aim comprise the use of audio and visual effects as decoration and to enhance fantasy, the use of randomness to add variety but not unreliability, and the use of appropriate humor. When the users found that their existing knowledge is incomplete or inconsistent, the interface should introduce latest or new information.

According to Malone, Lepper and Gentner, control is another aspect requisite for an intrinsically motivating game (Malone and Lepper, 1987; Gentner, 1990). Children's belief in their own control is positively correlated with academic achievement (Crandall *et al.*, 1965, in Gentner, 1990). Games offer a varied locus of control in the logic that the user initiates some of the actions and others by the computer (Gentner, 1990). According to Malone and Lepper (1987), it is the perception of control rather than actual control that is most important. According to them, a perception of control depends on the extent to which a player controls the likelihood of a result occurring and this can be produced through responsiveness and the provision of explicit choices. They further note, however, that providing a lot of choices can cause the player to lessen the value of choice and to experience frustration instead of satisfaction.

### 2.4.3 Designing Electronic Educational Game

Having found that educational games have been perhaps moderately effective at imparting learning, it is still uncertain why some games are efficient while others are not. Sedighian and Klawe (1996) argue that educational games should be designed to encourage reflective cognition of the players.

Activities are constructive in the sense that learners build their own understanding of the knowledge rather than accept an external mode. Lastly, reflective instruction occurs when students have the chance to consider the understanding they are developing and the process of application they are following.

#### 2.4.4 The Effectiveness of Game for Educational Purpose

Computer games have goals that children must achieve and when they successfully complete a level they get excited and when they don't they are motivated to learn more mathematics. Another important observation concluded that interactivity and communication help children learn mathematics because they can communicate their thoughts and regurgitate what they've learned. Many children were more attracted to fancy graphics such as colored animation, sound effects and music because it adds more flavor in playing the game.

Josephine, Barbara (1992) had done a research on the effectiveness of games for educational purposes and below is their findings:

1. 68 studies had been done directly or indirectly (in reviews conducted before 1984) on the difference between simulations/games and conventional instruction in student performance. 36 out of 68 studies show that they found no difference while 22 of the studies show that the participant found differences favoring simulations/games. Other than that, 5 of the review shows that they are favored simulations/games, but their controls were questionable while the rest found differences favoring conventional instruction.
2. Seven out of eight studies relating to mathematic subject found that the use of games is superior to traditional classroom instruction for improving mathematic achievement. Subject matter areas where very specific content can be targeted and objectives precisely defined are more likely to show beneficial effects for gaming.
3. The greatest number of studies on simulation/gaming is in the area of social sciences. The majority of these studies which is 33 out of 46, showed no dissimilarity in student performance between games/simulations and conventional instruction.
4. Five out of six studies verified that games can not teach language arts efficiently, particularly when specific aims are targeted.
5. The result also show that social science games be likely not to use a computer technology, while the other subject such as mathematic, physics, and language arts games tend to use it.



- 2.6
6. Simulations/games show greater retention over time than conventional classroom instruction.
  7. In 12 of 14 studies that being conduct, students reported that they are more interested in simulation and game activities than in more conventional activities.

## 2.5 Qualities of Effective Education Software

According to Frederick and Victoria (1985), it will be better to consider answers to these questions when planning the scenario for success with educational software:

1. Does the software have clear objectives?
2. Is there an effective instructional design?
3. What are the reward or reinforcement strategies?
4. Is the software interactive?
5. Does the software take full advantage of the computer's capabilities?
6. Is the software fail-safe?
7. Is there minimum keyboard interference?
8. Do programs meet adequate standards of clarity and accuracy?
9. What are the software's production qualities?
10. Is software documentation adequate?
11. Does the software offer timely and useful feedback?
12. Does the manufacturer invite feedback or offer updates?



## 2.6 Current System Problem

When teaching any subject, it is an advantage to know the students interest and weakness. The more we know or understand about them, the more expertly and securely it will drive their mathematical hooks. The associations and conclusions that we help the students to draw will be genuine, vivid and meaningful. Helping the students in learning it fine enough to teach it, keep it in mind their forever, and to use it meaningfully, quickly, without difficulty, correctly, and beneficially was one of the teacher's goal or aim.

Children develop the foundations for number manipulations starting with the natural and pleasurable inclination to count. There are some children that will discover the mysteries of mathematics without frustration or difficulty. Children learn pre-math skills through normal explorations, interactions with others, ordinary daily experiences, and play.

Ideally, each math concept should be introduced at the intuitive level, progress to the concrete, then to the pictorial or representational, then to the abstract, then to applications, and finally culminate at the communication level. (Sharma, 1990)

A good understanding of how each part works is needed in order to understand and master the language of mathematic.

As with reading-readiness skills, the teacher must assess in each student the existence and extent of math-readiness skills. Seven prerequisite skills have a profound impact on the ability to learn mathematics. These are

non-mathematical in nature, but are extremely important pre-skills that must be fully mastered before even the most basic math concepts can be successfully learned. (Sharma, 1989)

According to Piaget (1949, 1958), children learn primarily by manipulating objects until the age of 12. If children are not taught mathematics with hands-on methods, between years 1 and 12, their ability to acquire math knowledge is disturbed at the point when hands-on explorations were abandoned in favor of abstractions. This clearly sets them up for mathematical disabilities in the next developmental period of formal propositional operations. (CTLM, 1986)

In the end, teachers teach as they were taught. Their teaching style reflects their own learning style. Teachers need to realize that if students are experiencing difficulty, they should ask themselves the following questions: Is my teaching style excluding students with certain learning styles? Are the methods and materials I am using appropriate for and compatible with the student's cognitive level and learning style? Has the student mastered requisite skills and concepts? (Sharma, 1989)

Second, the teacher must understand that each student processes mathematics differently. Each person has a unique learning style or "mathematics learning personality." These different styles affect a student's processing, application, and understanding of material. Within every classroom, student styles are spread across a continuum ranging from purely quantitative to purely qualitative. (Sharma, 1989)

To effectively teach the entire class, the elements of both learning styles must be integrated and accommodated. To teach with one style, exclusively, is to leave out a great many students. If mathematic concepts are not matched to students' cognitive and skill levels- failure will inevitably result. The child will be forced into a position of needing remedial services to overcome their academic deficiency in mathematics. (Sharma, 1989)

By the age of 12, the academically neglected child has developed anxiety, insecurity, incompetence, and a strong dislike for mathematics because his experiences with it have been hit or miss. At this point, his symptoms become causative factors in the cycle of failure, math avoidance, and limited future educational and occupational opportunities. (Sharma, 1989)

## 2.7 Recommended Way in Teaching and Learning

### Mathematic

Below is Sharma's Recommended Teaching Sequence for Mathematic Concepts:

#### 1. Inductive Approach for Qualitative Learners

- Explain the linguistic aspects of the concept.
- Introducing the common theory, fact, or law that other truths hinge upon.
- Let the students to use investigations with existing materials to determine proofs of these truths.



- Provide to the students with several specific examples of these truths via the real resources or concrete materials.
- Have the students speak out their discoveries about how the theory works.
- Finally, show how these individual experiences can be included into a broad principal or rule that pertains similarly to every example.

## 2. Deductive Approach for Quantitative Learners

- Use the usual deductive approach.
- Re-emphasize the general law, rule, theory, or truth that other mathematical truths hinge upon.
- Then show how several specific examples obey the general rule.
- Have students state the rule and offer particular examples that comply with it.
- Have students give explanation about the linguistic elements of the theory.

There are six levels of Learning Mastery as recommended by Sharma and it was stated below:

1. Intuitive Connections: Student relates or connects the new perception with presented or existing experiences and knowledge.



2. Concrete Modeling: Student looks for concrete material in creating a model or shows a manifestation of the theory.
3. Representational or pictorial: Student sketch to illustrate the concept and he connects the concrete (or vividly imagined) example to the symbolic representation or picture.
4. Symbolic or Abstract: By using number symbols, operational signs, formulas, and equations, student transfers the concept into mathematical notation.
5. Application: Student applies and relates the concept effectively to actual world situations, story problems, and assignments.
6. Communication: Student is able to communicate it during a test and can teach the concept successfully to others. (Sharma, 1989)

## 2.8 Computer Technology in Teaching and Learning Mathematic

### 2.8.1 Introduction

The growth of the technology had become one of the important roles in the educational process. Technology had been emerged with school curriculum as one of the method used to plant and manure interest towards the growing of technology.

School culture need to be improved using the latest technology because of the government's plan to develop Smart School and the implementation of Multimedia Super Corridor (MSC). The development of

Smart School will help in making the education system more flexible. This will decrease the gap between those who are rich and were able to use the latest technology and those who are poor and unable to do so.

## 2.8.2 CD-ROM Based Learning

### 2.8.2.1 What is CD-ROM based learning?

CD-ROM based learning refers to the use of CD-ROM technologies in delivering a broad array of solutions that enhance performance and knowledge. With CD-ROM which is rich with multimedia content and capability, CD-ROM Based Learning can simulate a huge number of percentages of classroom training with other added advantages.

### 2.8.2.2 Advantages of CD-ROM based learning

#### 1 Effectiveness & Retention

It is a normal phenomenon that students lost or forgotten what they have learnt within a period of time. It is human nature to learn by repetition to gain back their memory on what they have learned before. As a result, CD-Rom Based Learning had played an important role to allow user to refresh or repeat as many times as they like until they had master the material before they proceed to the next topics or modules.

#### 2 Anytime and Anywhere

With the CD-ROM, it allows students to learn virtually anytime, anywhere and whenever they want to. The CD-ROM is portable anywhere the user go and it makes learning process more flexible.

### 3 Speed and consistency

With CD-ROM Based Learning, there is no limit to its scalability and it can be used to train as many people as possible at the shortest possible time-frame at a very attractive cost & consistent training results and in a flexible way.

### 4 Pacing-Learn at own pace

Another valuable reason for using CD-ROM Based Learning is that the control it allows students in the learning process. In an instructor-led course it's hard to address all of the different levels of knowledge students bring to the course. CD-ROM Based Learning courses allow each and every student to proceed at his/her own pace, skipping material they already know and when necessary, rewinding the material as well as reviewing new concepts.

### 5 Fits user's schedule

Other than all the advantages that I state above, there are another benefits that user can gain through CD-ROM Based Learning. It was the flexibility for the user to use the CD-ROM at home or in school whenever & wherever time permits.

#### **2.8.2.3 Limitations of CD-ROM based learning**

Although there are lots of advantages of using a CD-ROM based learning but there are some limitations in using it. One of the limitations is that to run a CD-ROM Based Learning, user will need a multimedia PC and other than



that it cannot be installed on the network easily due to the requirement of high bandwidth on most of the CD-ROM based Learning content. For CD-ROM Administration it will need to have many CD-ROMs for various topics.

#### **2.8.2.4 Considerations on Implementing a CD-ROM based learning solution**

Having understood the benefits and limitations of CD-ROM Based Learning, the consideration below is needed when implementing a CD-ROM Based Learning Solution:

##### **1. Interesting & Compelling Content**

The content of the CD-ROM should be interesting and attractive and also compelling for users to continuously using it and will gain benefits from it.

##### **2. Contents & Application**

A lot of information can be put inside the CD-ROMs for various learning needs and for various type of user's level.

## **2.9 Review or Analysis on Other Educational Games**

### **2.9.2 ClueFinders 4<sup>th</sup> Grade Adventures**

ClueFinders is one of the products from The Learning Company which runs from the CD-ROM drive. However, the requirement of 100 MB of free hard disk space is needed to store some program files. ClueFinders 4th Grade Adventures is an adventure game that builds on fourth graders' interest in mystery and adventure as well as their abilities in mathematics, language arts, geography, science, and logical thinking. Each activity in ClueFinders



2.9.3 4th Grade Adventures has several levels, so the program can shift from simple to more difficult concepts at a pace that suits each player. In ClueFinders 4th Grade Adventures, a friendly character explains each activity. This explanation aims to support players in understanding what they are being asked to do.

However, from my analysis I found that there are some disadvantages in this game such as the User's Guide that is in PDF format. User with no Acrobat Reader program will be facing problems to obtain the information from the manual provided. Another problem that user might face is when they are in the main page of the adventure. This is because they will easily get confuse because of the introduction of the other product from the company who develop this game.

Although the user can choose the modules that they want to play without going through the adventure but if they choose to go through the adventure, it will waste user's time because I found that the introduction before the adventure starts was too long. As the result it will make the user get frustrated waiting for the game to start if they choose to follow the adventure. Besides, the user also needs to go through a long adventure before they get involve in the games and this will make the user easily get bored.

The background music in this game was not so suitable and not attractive. The motivation that the character in each game gives was almost the same in each question. Other than that in most of the module in this game provide the question in each game only in audio form and this will make the game not suitable for disable children such as those who had difficulty in hearing.

### 2.9.3 Bear and Penguin's Big Maths Adventure

This is one of the products from Dorling Kindersley Interactive Learning which is based on the concept “play and learn”. It can be used to develop skills and builds confidence through intelligent, self-adjusting software and also include a reward system that contains a mystery bonus game which provides incentives and positive reinforcement. Other than that it also provide user with user guides. The guides that it provide is full of detail and it includes solution for user when they face problems such as animation problems, sound problems, display problems, memory problems and printing problems. The interface that they develop is very attractive and user-friendly.

However there are some minor weaknesses in this CD-ROM such as the repeating motivation from the character in it and they only provides the games with two mathematic operations such as addition and subtraction. In my opinion, I feel that this games is very interesting and it have the multimedia interactive features and user-friendly.

### 2.9.4 [www.funbrain.com](http://www.funbrain.com)

Other than doing review and analysis on the CD-ROM based existing system, I also did some review on the online educational games. One of the website that I have referred and analysis is [www.funbrain.com](http://www.funbrain.com). This is an online educational game that is suitable for kids, teachers and parents. Their target users are age from 6 and above. The products that they offer are games for variety of choices such as numbers, culture, words and other topics.

In my opinion the interface was very attractive and the instructions are provided for each game. Users have the freedom to choose the level of



Mathematic games and can also choose the total of player other than select the algebra style. Besides, they also offer the tips and resources to help parents in parenting.

However I feel that it was not user-friendly and the games are not interesting. Children may find it was a boring game after they play for several times.

### 2.9.5 [www.funschool.com](http://www.funschool.com)

I also did my review and analysis on [www.funschool.com](http://www.funschool.com). In my view, I feel that it was very attractive and easy to navigate. They offer several levels of games from preschool children and above.

But one of the advantages that I find was it need some time to load.

## 2.10 Information Gathering and Findings

I have chosen several types of ways in gathering and seeking the essential information before I start develop my system such as from printed media for example books, electronic media such as web site, and survey and from my lecturer's guidance.

### 2.10.2 Printed Media

To help me in collecting the data or information that is relevant to the system that I will develop, I have chosen some books as my reference. Other than that I also refer to some thesis written by previous year student and some reading on the latest technology from newspapers and magazines to ensure that the system that I will be developing is up to date. Although printed media



did not play a very important roles in my findings but it did contribute in increasing my knowledge in building a system and also provide me with the essential knowledge.

## 2.10.4 Electronic Media

### 2.10.3 Survey

Other than using printed media, I also had done some survey before developing my system. It is done by finding the existing interactive multimedia games that are sold in the market and by having informal interview with teachers and a few students age between 9 and 12.

There are two types of system that is available which are online educational games are and the other form of system is in CD-ROM based. For CD-ROM, I have analyzed on two products that are quite famous in the market which are Bear and Penguin's Big Maths Adventure and ClueFinders 4<sup>th</sup> Grade Adventures. Other than that I also do my survey on two online educational games that are [www.funbrain.com](http://www.funbrain.com) and [www.funschool.com](http://www.funschool.com). Please refer to Chapter 4 for more detail.

Although I just conduct an informal interview but from the interview, I get to understand more about the way they learn, teach and how important is the educational games in playing the role in their normal learning and teaching environment. They had also provided me with more essential information when I ask their opinion regarding playing games in achieving improvement in Mathematics. Although majority of the students are not really being reveal about learning through educational software but there are minority that did apply this type of learning. The conclusion is, by developing

this educational games, I wish that it will help in reveal to the student the benefits of using the educational game in learning Mathematics

#### 2.10.4 Electronic Media

The electronic media that I use for my findings are the website from the internet. I have use search engines such as Yahoo's and Googles for searching information. To search for the information, the specific keywords based on the type of information needed were used to search the necessary information. Personally, I feel that the internet had helped me a lot in findings information for my project. The internet not only provides a variety of information but also the fastest way and effective way of finding information.

#### 2.10.5 Guidance from lecturer

The advice and opinions from Mr.Teh my supervisor and Dr.Rukaini, my moderator, had guided me through the process of developing the games. Other than that, from the discussion with both of them, I have gain the information about how to gather the relevant information as well as making sure that the content are accurate.

## 2.11 Development Tools

### 2.11.2 Authoring Tools

#### Macromedia Authorware 6.0

Macromedia Authorware 6.0 provides a powerful environment for creating and presenting interactive information. Authorware basic features let user develop presentations quickly and easily, while advanced features offer greater authoring control.

#### Macromedia Director 8.5 Shockwave Studio

Macromedia Director 8.5 Shockwave Studio is one of the tools in the market that provides a high-performance solution for video where it enable user to use long video files in their native format. Other than that it also can be use to generate extensible multimedia content that utilizes streaming video, including advanced 3D games and learning applications, deployable across various mediums.

#### Macromedia Flash MX

Macromedia Flash MX is an authoring tool that can be used to produce streaming vector animation, lightweight video, and Rich Internet Applications, both for online and offline applications. It has a core set of prebuilt, customizable components that enable the user to develop interfaces for web forms and applications easier and faster.



## Comparisons

Table 2.1: Macromedia Director 8.5 and Macromedia Flash MX Comparisons

	Macromedia Flash MX	Macromedia Director
<b>Activity/Content</b>		
Deploying to fixed media (i.e., CD, DVD, kiosk)		✓
Website user interfaces	✓	
Interactive real-time 3D		✓
Video: Long form		✓
Video: Short (less than two minutes) form	✓	
Internet-based rich media applications	✓	
Accessible rich media	✓	
Large applications suited for CD or DVD distribution (hundreds of megabytes)		✓
Customized applications		✓
Multiple media formats needed		✓
High performance		✓

Launching external applications		✓
Access to file systems		✓
More input devices		✓
Precision sound control		✓
Content with many objects on the Stage, including high-performance games		✓
Online advertising	✓	
Content for devices	✓	

Table 2.2 : Adobe Illustrator 10 and Macromedia Shockwave Studio 10 Comparison

### Advantages of using Director 8.5 and Flash MX together

Macromedia Flash and Director Shockwave Studio are both a powerful rich-media content solutions. When it is used together, they enable developers and designers to produce more compelling and efficient rich content, both for on-line and off-line applications.

#### 2.11.3 Graphic Tools

##### Adobe Illustrator 10

Adobe Illustrator 10 is software that can be used to produce artwork which can be published on Web pages, PDAs, wireless devices, and in print. It also provide features like live distortion, object-based slicing, and dynamic data-driven graphics that deliver exciting new imaginative options, improve

productivity, and simplify the production of graphics for the Web and also other media.

### Macromedia Freehand 10

Macromedia FreeHand 10 offers significant web functionality and can be apply for creating extraordinary illustrations, lay out graphics-rich print documents in a unique multi-page workplace, design web site storyboards, and include animation and interactivity to bring the designs to life online. It also has sophisticated vector-based illustration tools like Contour Gradients and Symbol-based brush strokes for producing complicated designs easily.

### Adobe Illustrator 10 and Macromedia Freehand 10 Comparisons

Table 2.2 : Adobe Illustrator 10 and Macromedia Freehand 10 Comparisons

Activity/Content	Adobe Illustrator 10	Macromedia Freehand 10
Multiple stroke and fills for object	✓	
Gradient Mesh	✓	
Interactive controls for polygons, star, spiral, arc, flare and grid symbol	✓	
Symbols Libraries	✓	✓
Graphic symbols of selected object	✓	✓
SVG and Data-driven Graphics	✓	
Flash animations with frame rate settings	✓	✓



Symbols maintained when exported into Flash	√	√
HTML code for SWF output	√	√
Live effects applied to objects and groups	√	
Live distortions and transformations	√	
Live feathering	√	
CMYK color mode	√	
JavaScript support	√	
Microsoft Visual Basic support	√	
On screen pixel review	√	
Browser dither previews	√	
Group, layer and sub layer transparency	√	

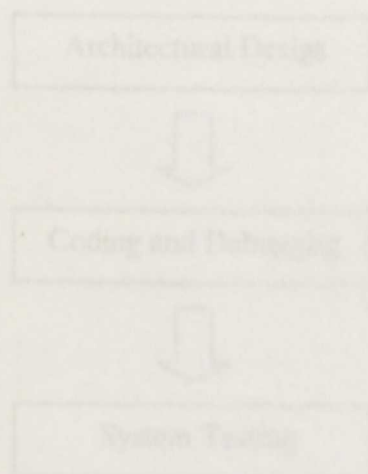


Figure 3.1: System Development Life Cycle 3 Steps

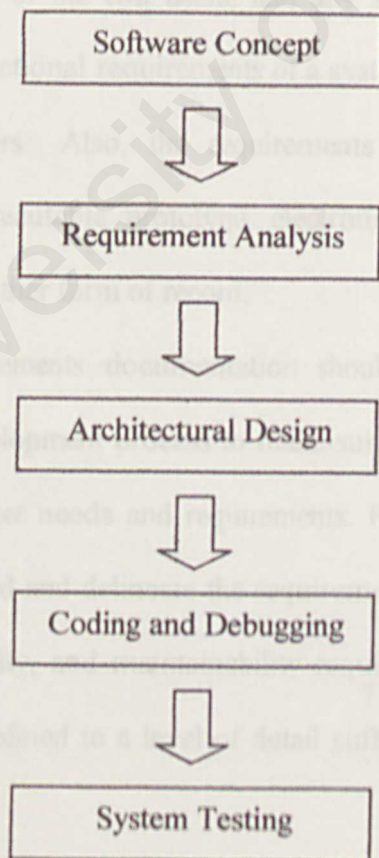
## CHAPTER 3: Methodology

### 3.1 System Development Life Cycle (SDLC)

The System Development Life Cycle, which is also identified as Application Development or Information Systems Development, is the process for developing information systems. The processes that involve are investigation, analysis, design, implementation, and maintenance.

The SDLC methodology is applicable, in part or whole, once any system is being developed, modified, or deleted. This methodology is used to apply to computerized systems, and automated or non-automated processes.

Below are the steps that is contained or involved in the System Development Life Cycle. Each phase within the cycle may be involving more than one step.



*Figure 3.1: System Development Life Cycle's steps*

### 3.1.1 Software Concept

The first step in this software concept process is to recognize a need for the new system or the system that will be developing soon. For software development company, this process may need the participation of end users who turn up with a suggestion for improving their work or sometimes may only involves those who are Information System people but for my project I only do some review on existing system (CD-ROM based) and findings from internet to view on existing online games and some other research that is related to my project.

### 3.1.2 Requirements Analysis

Requirements analysis is the method of investigating or analyzing the information needs of the end users, and any system currently being used, developing the functional requirements of a system that can meet up with the needs of the users. Also, the requirements should be recorded using documentation, executable prototype, electronic mail, storyboard for user interface or some other form of record.

The requirements documentation should be referred through the whole system development process to make sure that the developing project well-suited with user needs and requirements. Functional user requirements are formally defined and delineate the requirements in terms of data, system performance, security, and maintainability requirements for the system. All requirements are defined to a level of detail sufficient for systems design to proceed.



3.2 The activity in this phase includes:

1. collecting facts and information
2. analyzing system requirement
3. ranking the requirement
4. generating alternatives and selection

### 3.1.3 Architectural Design

Once the requirements have been determined, the essential specifications for the hardware, software, people, and data resources, and the information products that will suits the functional requirements of the planned system can be determined. The design will serve as an outline for the system and helps to discover the problems before these errors or problems are constructed into the final system.

### 3.1.4 Coding and Debugging

Coding and debugging is the act of producing or developing the final system. This is the step for developing and preparing for the system to operate. Coding is the most important activities because it was the activity that will make the planning or system successful.

### 3.1.5 System Testing

To evaluate its actual functionality in relation to expected or intended functionality after the system had been developed, the system will be tested.

### 3.2 Waterfall model with prototyping

To develop my system, I had chosen the model which is a combination of the waterfall model and the prototype model. Below are the figures showing the model:

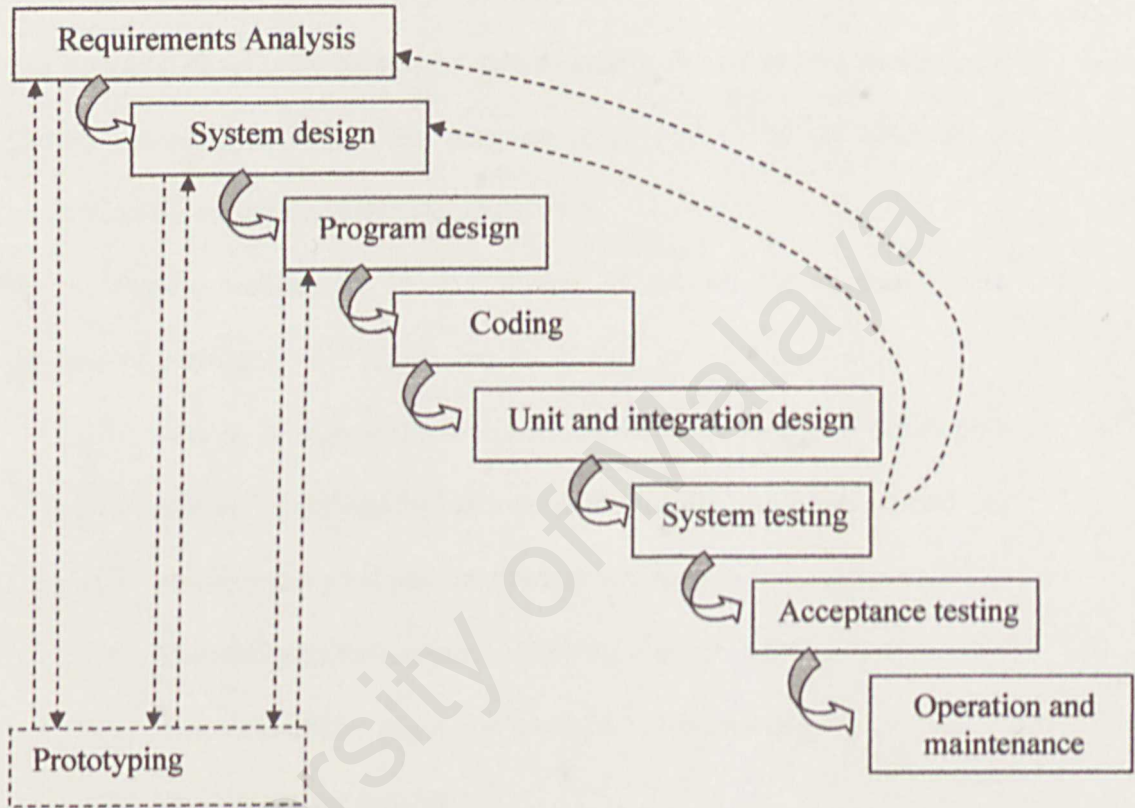


Figure 3.2 : Waterfall Model

In a waterfall model, each development stage has to be completed before proceeding to the next. For example, in the first stage all the requirements are elicited, analyzed and documented before designing the system. Overall, the model in a well documented process. With the addition of the prototype model as the sub-process, contain aspects of the system can be reviewed and tested to check its functionality and whether it meets the specific requirement

yet possibly changing needs of any application. This way, major problems can be avoided as errors can be detected at early stage.

## 4.1 Introduction

System analysis is a systematic investigation of a real or planned system to determine the functions of the system and how they relate to each other and to any other system. Depending on the context and constraints of the package, developers should be able to clarify the interactive multimedia project rationale, to define the program scope and to set up methods of evaluation by creating a preliminary analysis.

Typical constraints in the design of an interactive multimedia application include:

- Media configuration and performance. For example developers might have multi-platform development strategy aimed at producing a good multimedia application.
- The ability of the project team about the subject.
- The accessibility of related multimedia documentation.
- The budget and deadline.

The look and feel, interface and functionality of existing interactive multimedia application should be evaluated. It often helps to make a chart of comparative features of existing applications. Looking at these applications will reveal the puzzle that multimedia design and production represents. Production is always governed by the delivery requirements, hardware limitations, storage capabilities and the speed of the programs that present the information. All the existing products analyzed will demonstrate the trade-offs the developer had to deal with in order to bring the project to the perceived market. The program speed, the hard disk storage and access and



# CHAPTER 4: System Analysis

## 4.1 Introduction

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the memory limitations have all been juggled to create the best application for the investment.

## 4.2 The requirement process

Before developing a system, it is very important to capture all the necessary requirements. A requirement is a characteristic of the system or descriptions of the capability of the system in fulfill the system's purpose (Pfleege, 2001). As for this project, the requirements were gathered through research and finding from the Internet and books and review of the existing systems.

Figure 4.1 : Process of determining the requirements

### 4.2.1 Requirement elicitation

Requirement elicitation is an especially critical part of the process. A variety of techniques must be used to determine the user's need and what they really want from the system that will be develop. The requirements can be categorize into three categories which are:

1. the requirements that absolutely must be met
2. the requirements that are highly desirable but not necessary
3. the requirements that are possible but could be eliminated.

A functional requirement describes or explains how the interaction between the system and its environment happens. It also describes how the system should behave given certain stimuli (Pfleege, 2001).

As mentioned earlier, the Interactive Multimedia Educational Games which we name it as KidsHeaven will be divided into two modules which are FunMaths and FunScience. My project will only focus on the FunMaths

Below are the figures of the process of determining the requirements.

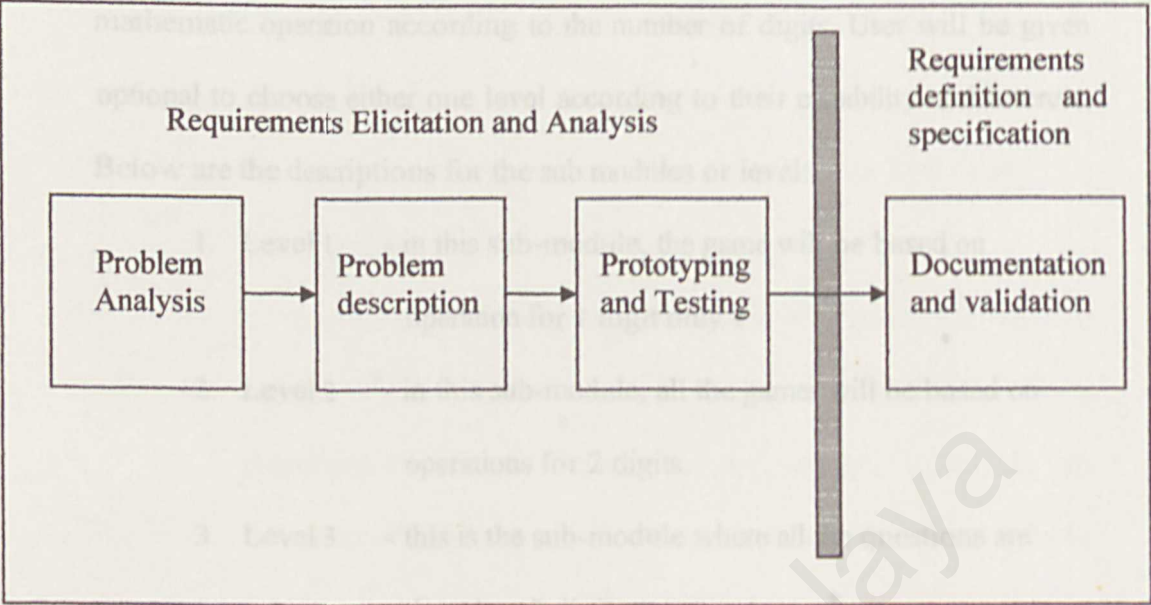


Figure 4.1 : Process of determining the requirements.

#### 4.2.2 Requirement for Interactive Multimedia Educational Game (FunMaths)

From the analysis and the information gathered, the outline for FunMaths is prepared. Basically, requirements are separated into two namely functional requirements and nonfunctional requirements.

##### 4.2.2.1 Functional Requirements

A functional requirement describes or explains how the interaction between the system and its environment happens. It also describes how the system should behave given certain stimuli (Pfleeger, 2001).

As mentioned earlier, the Interactive Multimedia Educational Games which we name it as KidsHeaven will be divided into two modules which are FunMaths and FunScience. My project will only focus on the FunMaths



module. For FunMaths, it is based on mathematic operation and is divided into 3 levels, where each level consist of question based on all the mathematic operation according to the number of digits. User will be given optional to choose either one level according to their capability and interest. Below are the descriptions for the sub modules or level:

1. Level 1 - in this sub-module, the game will be based on operation for 1 digit only.
2. Level 2 - in this sub-module, all the games will be based on operations for 2 digits.
3. Level 3 - this is the sub-module where all the questions are based on 3 digits.

There are three main buttons which are the 'Home' button, 'Help' button and 'Quit' button that let the users navigate the games easily. 'Home' button will let the users to go back to the main screen to choose again either science or mathematics games that they want to play and the 'Help' button is provided to guide the users in the mathematics or science games and also on some introduction. While the 'Quit' button can let the users stop playing and quit the games. There are also instruction on how to play the game in each level that will be shown when user click on the instruction button. Other than that there are also three buttons in every page of the game which enable the user to select the level and also four button in each level where user can choose to play either addition, subtraction, multiplication and division.

#### 4.2.2.2 Nonfunctional Requirements

Nonfunctional requirements or constraint describes a restriction on the system that limits our options for creating a solution to the problem (Pfleeeger, 2001).

Below are the nonfunctional requirements that are needed for FunMaths:

1. User-friendly

I will be developing the game that will enable the user to browse the CD-ROM without any problem or frustration. It is very important to make sure that users are comfortable and do not encounter difficulties while using the system. The game will be based on the easy-to-use concept and there will be a talking wizard to gives the users guide and assist them whenever needed. The graphical user interface will help user in pointing and click their way round easily.

2. Attractive interface

The interface that I will design will be a very graphical one and colorful because or the target user who was kids around 7 to 12 years olds. Other than that, my reason is to attract and maintain children's interest and attention. The graphics used will be based on cartoon character and a reasonable amount of animation would be implemented in this game.

3. Easy to navigate

The navigation in this game will be as simple as possible so that it will suit the ability of the target user. The navigation button

and icons will be based on graphical and symbols so that it will be easy to understand.

#### 4. Interactive

This feature will enables interactivity between users and the computer platform. Although it is use in describe hardware but it can also be used to describe software and it is increasingly used in this way. For an offline application this could mean the operating system such as Windows 98, while for an online project it is more likely to refer to the browser such as Mozilla, Netscape Navigator or Internet Explorer. A useful definition might be that the platform is whatever you have to specify in order to run the application. Often the specification will be extended to include what kind of display is needed, or how big a hard disk, or how fast an Internet connection.

#### 5. Learn ability

This refers to the ease with which new and occasional users may accomplish certain tasks in using the FunMaths system. Users will be able to understand faster and more effective the most basic comments and navigation option and use them to choose the modules that they prefer. They will be having no difficulty in remembering how to use and navigate in the system after a period of time of non-use.

#### 6. User satisfaction

The game is designed to be enjoyable to use and pleasing to users. User satisfaction will be within acceptable levels of users cost in terms of tiredness, discomfort and individual effort so that the satisfaction causes continued and enhance the usage of the FunMaths system.



## 4.3 Hardware and software requirements

### 4.3.1 Choosing the platform

The word 'platform' was traditionally associated with hardware: the computer platform. Although it is used to describe hardware but it can also be used to describe software and it is increasingly used in this way. For an offline application this might mean the operating system, such as Windows 98, while for an online project it is more likely to refer to the browser, such as Mosaic, Netscape Navigator or Internet Explorer. A useful definition might be that the platform is whatever you have to specify in order to run the application. Often the specification will be extended to say what kind of display is needed, or how big a hard disk, or how fast an Internet connection.

### 4.3.2 Delivery Platform

For multimedia there are some issues that we need to consider in delivering the platform such as screen resolutions and bit depth, sound parameters, the speed of the CD-ROM drive, the way that video is handled, the amount of RAM and the size of the hard disk.

For performing the best result, we have to choose the platform that best suited to deliver the multimedia vision. Research has been done to find a lowest common denominator for the machinery users have:

- i) type and speed of processor (and therefore performance) - Pentium 366 Mhz and above
- ii) amount of memory (RAM) - 8 MB RAM and above
- iii) size of hard disk - 2 GB and above with 500MB of free disk space
- iv) operating system - Windows 98 and above

- v) resolution of the screen – 640 x 480 pixels and above
- vi) number of colors on the screen – 256 and above
- vii) sound handling (8 bit and above)

#### 4.3.3 Delivery Medium

The delivery medium defined by which you get your application to the user. Here, the delivery medium that we have chosen is CD-ROM. This medium has become so universal that it seems unlikely that it may ever lose its supremacy as a carrier.

#### 4.3.4 Development Platform

##### Processor

Processor is a common term for any device that is capable of carrying out operations on data. Sometimes it is used as a synonym for central processor. To develop this system the minimum of Pentium 133Mhz is needed.

##### Sound card

Sound card was the extension board that enable computers in manipulating and output sounds and it was almost necessary for all CD-ROMs and have become commonplace on new personal computers. The capability of sound card had provided me with the ability in adding sounds and background music to my project.

### Speaker

Other than sound card, I have used speaker as a device for output the sounds and to test the sound or music that I have added to the game.

### Modem

Modem is a device that connects peripherals, and that converts and reconverts digital signals from a computer into tone variations (in serial form) for transmission over standard telephone. I have used this hardware to get connected to the internet and it helps me in doing research on the internet.

### CD-RW drives

I have chosen CD-RW drives as one of the hardware that I use to develop my system because of its ability to write data on a CD disk for several times. This enable me to transfer any data or my system into a CD as the game that I will develop will be in CD-ROM based.

### Random Access Memory (RAM)

RAM is the memory items that may be accessed directly by the central processing unit (CPU) and it also usually signifies readable, writeable portion of addressable main memory. To make the system development moving smoothly, the minimum requirement of RAM is 64MB.



### 4.3.5 Development Tools

Below are the tools that I will be used for developing the system:

#### 4.3.5.1 Authoring tools

I have chosen three authoring tools which are Macromedia Director 8.5, Macromedia Authorware and Macromedia Flash MX to help me developing the system. Below are some relevant information that I gained during my research of the tools that I have chosen.

##### **Macromedia Director 8.5**

Macromedia Director 8.5 Shockwave Studio lets users create the most media-rich, high-performance learning, entertainment, and merchandising applications for deployment to multiple environments, including the Internet, CD/DVD-ROM, and kiosks.

##### **Director 8.5 Shockwave Studio can use to:**

1. Create streaming, interactive, multi-user content using:
  - Interactive 2D and real-time 3D animation
  - Video: RealVideo, QuickTime, AVI
  - Sounds: RealAudio, MP3, AIF, WAV
  - Graphics: JPG, GIF, PNG, PSD, BMP, and more
  - Macromedia Flash
  - Text and fonts
  - And more, through Xtras

2. Deploy to fixed media.

The performance, media handling, and extensibility of Director 8.5

Shockwave Studio make it ideally suited for deploying content on CD-

ROM, DVD-ROM, kiosks, and other fixed media.

3. Get maximum performance with large files.

Quickly load and unload hundreds of megabytes of data into system

memory with Director 8.5 Shockwave Studio advanced memory

management. The result is consistent, smooth playback for end users.

4. Take control with the extensibility of Director 8.5 Shockwave Studio.

Launch other applications from within Director 8.5 Shockwave Studio;

use input devices such as joysticks, and integrate custom functionality for

the absolute best user experience.

5. Use media-heavy content such as bitmaps, sound, and long video streams.

With the advanced compression, extensive media support, and fast

rendering engine of Director 8.5, user can make media-rich content that's

lightweight and high-performance Shockwave Studio. Director 8.5

Shockwave Studio supports many image formats such as GIF that user

can use to create small, non-photo-realistic images and its programming

language Lingo were designed to quickly animate many sprites (bitmaps,

vectors, etc.) on the Stage for high-performing content.

## **Macromedia Authorware 6.0**

Macromedia Authorware 6.0 provides a powerful environment for creating and presenting interactive information. Authorware basic features let user develop presentations quickly and easily, while advanced features offer greater authoring control.

Authorware 6 allows user to:

- Extend the expressiveness of e learning content with new authoring capabilities, including the ability to direct events over time.
- Publish projects for the Web or CD-ROM quickly and with one-button ease.
- Deliver powerful e-learning applications that leverage learning and Web standards

### **Macromedia Authorware features included:**

#### **1. One Button Publishing**

One button publishing integrates and automates all the steps in the publishing process, making it possible to deliver applications for the Web, CD-ROM or corporate network with the click of a button.

#### **2. MP3 Streaming Audio**

Leverage low-bandwidth MP3 audio to audio-enable e-Learning applications designed for intranets and the Web.



### 3. Media Synchronization

Direct events over time by synchronizing the display of text, graphics and other events with time-based media including audio and video files.

### 4. Rich Text Editor

Create rich text files with a new editor that provides advanced formatting cap supporting extended properties and methods of ActiveX controls.

### 5. Smaller Web Player

Downloads Authorware 6 content over the Web, is 40% smaller.

### 6. SCORM Metadata Editor

Create a standards-compliant metadata file for your courses to make your e-Learning content easy to manage, reuse and deploy.

### 7. Rich Media Learning Aids

Get started fast with an interactive, multimedia tutorial on Authorware built right into the Help system.

## **Macromedia Flash MX**

Macromedia Flash 5 is the professional standard for producing high-impact Web experiences. Macromedia Flash 5 allows user to fuse vector graphics with bitmaps, audio, animation, and advanced interactivity to create unique and effective Web sites.

### **Macromedia Flash MX Features**

#### **1. Drawing**

The drawing tools in Flash let the user to create and modify shapes for the artwork in the movies. Flash provides various tools for drawing freeform or precise lines, shapes, and paths, and painting filled objects. Drawing settings can be set to specify snapping, smoothing, and straightening behaviors when user use Flash drawing tools. They can change the Tolerance setting for each option, and turn each option off or on. Tolerance settings are relative, depending on the resolution of your computer screen and the current magnification of the scene. By default, each option is turned on and set to Normal tolerance.

#### **2. ActionScripts**

Flash uses the ActionScript scripting language to add interactivity to a movie. ActionScript is the scripts that tell Flash what action to perform when the event occur. Similar to JavaScript, ActionScript is an object-oriented programming language. In object-oriented scripting, information is will be organize by arranging it into groups called classes. Objects in ActionScript can contain data or they can be graphically represented on

the Stage as movie clips. User with no programming background can start writing simple scripts without knowing much about ActionScript. All they need is a goal and picking the right actions.

### 3. Drawing animation

Animation can be created by changing the content of successive frames. Object can be made to move across the Stage, increase or decrease its size, rotate, change color, fade in or out, or change shape. Changes can occur independently of, or in concert with, other changes.

There are two methods for creating an animation sequence in Flash: frame-by-frame animation and tweened animation. In frame-by-frame animation the image is create in every frame. In tweened animation, user can create starting and ending frames and let Flash create the frames in between. Flash varies the object's size, rotation, color, or other attributes evenly between the starting and ending frames to create the appearance of movement.

Tweened animation is an effective way to create movement and changes over time while minimizing file size. In tweened animation, Flash stores only the values for the changes between frames. In frame-by-frame animation, Flash stores the values for each complete frame.

### 4. Adding sound

Flash offers a number of ways to use sounds. User can make sounds that play continuously, independent of the Timeline, or can synchronize animation to a sound track. Sounds can be attached to buttons to make



them more interactive, and make sounds fade in and out for a more polished sound track. The quality and size of sounds in exported movies can also be control.

#### 5. Publishing and exporting overview

The Export Movie command provide the possibility to create Flash content that can be edited in other applications and export a movie directly into a single format. For example, user can export an entire movie as a Flash Player file; as a series of bitmap images; as a single frame or image file; and as moving and still images in various formats, including GIF, JPEG, PNG, BMP, PICT, QuickTime, or AVI.

#### 4.3.5.2 Graphic tools

##### Adobe Photoshop 7.0

Adobe Photoshop 7.0 is the professional image-editing standard that helps user to express their creativity and work efficiently. With Photoshop 7.0, user can more easily produce exceptional imagery for print, the Web, wireless devices, and other media.

##### **Adobe Photoshop features**

#### 1. Actions

The batch processing and task automation was support by the Actions in Photoshop. The ability of Actions that enable users to record a series of editing steps as an Action can be applied to any other selection in the different location such as in the same image, to another image file, or

even to hundreds of files in a batch operation. In order to interactively adjust the filter setting, during the playback, users can play an action with selected steps disabled or display selected dialog boxes. Various actions can be displayed at the same time in the Actions palette, and sets of actions can be saved and loaded separately. One of the unique features of Actions is the ability to batch-acquire images from a digital camera. For image editing in Photoshop, Actions will have a dramatic impact employed. This feature enables the print production shops to handle the process of hundreds of files which are unattended. While individual can computerize their most common tasks and allocate their action lists for sharing with other users.

## 2. Adjustment Layers

Without permanently modifying the original image special layers this features can be applied. An adjustment layer is a mask through which an image adjustment is applied. Numbers of adjustment layers can be loaded in the Layers palette, each adjustment layer modifying the layers that lie below. Similar to an image layer, an adjustment layer does not make permanent changes to the original image pixels. Although after the adjustment layer being modified for several times but the image quality will still remain the same. This feature encourages the user to experiment on their images. The layers can be modified to affect different image layers. The same opacity and blending mode controls are also offered for image layers. Via any painting tools on the adjustment layer, color and tonal adjustments can be simply interactively "painted" onto the image.

### 3. Free Transform

With unparalleled control and image fidelity, it allows numerous transformations. Besides, it also enable the users in a single step, to scale, rotate, skew, add viewpoint to, or else distort a selected image area. Because of the image that does not need to be recalculated multiple times it helps in greater image fidelity and at the same time, it makes complex manipulations of images easier.

### 4. Navigator

The Navigator offers rapid and precise access to magnified view of an image and a more efficient method for adjusting views of large images. User can progress rapidly to any position in a magnified image, by clicking the preferred view section within a resizable thumbnail of the image.

### 5. Guides and Grids

Photoshop provides standard features of page-layout and illustration programs to image-editing. Guides provide accurate either horizontal or vertical lines to which tool operations can be snapped and the Guides settings are also recordable actions, making it straightforward in defining a particular guide setup to be shared with other users or applied to a number of documents. Similarly, the Grids attribute creates a regular pattern of snap points across the whole image.



## 6. Digital Watermarking

This feature introduces a capable technique for artistic professionals to shield the copyright of their images. The watermark is still readable even after an image has been modified, or printed and re-scanned. Users can obtain copyright and artist information for registered images after Photoshop has read the watermark by linking the program to Digimarc Web site. Adding a watermark to images can also be done automatically by the Actions feature. The Actions features also provide to the user the capability to add a digital watermark to multiple images in a group process.

## 7. Multicolor Gradients

The Photoshop did provide the supports for linear and radial gradients with varying levels of opacity and a wide variety of colors. Whenever a custom gradient is applied, the actual colors can be defined for the gradient designs, or the present background and foreground colors can be inserted automatically. Other than that it also allow the users to save their own custom gradient styles and allocate them for sharing with other users on either Windows or Macintosh platforms.

## 8. History Palette

In Adobe Photoshop, the History palette liberates you, letting you undo and redo multiple editing steps instantly. The History palette tracks and displays a complete list of recent editing steps. You can review and move among these different stages by clicking anywhere in the list. You can

save snapshots of an image to quickly compare different stages, and you can paint the contents of a previous editing stage onto the current image with the History brush.

## 9. Integrated Adobe User Interface

Photoshop integrates tightly with Adobe's full line of professional publishing and dynamic media tools. Photoshop shares a common user interface and in some cases, even core technologies - with Adobe Illustrator, Adobe InDesign, Adobe Premiere, Adobe After Effects, and other Adobe products. User can work more efficiently and produce better results using this smooth integration across applications.

### Adobe Illustrator

Adobe Illustrator provides a superior toolset for creating sophisticated artwork, technical illustrations, information graphics, and page designs for print, multimedia. Adobe Illustrator sets the industry standard for computer-based illustration and design.

### Adobe Illustrator Features:

#### 1. Gradients Palette

Users can quickly create smooth graduated blends between two or more colors or tints with the new Gradients palette. Users specify whether the gradient is linear or radial, and they set the angle of the blend.

## 2. Text Enhancements

The Character and Paragraph palettes can precisely control point size, leading, kerning, tracking, baseline shift, horizontal scale, hyphenation, paragraph indentation, letter and word spacing, and other text attributes. In addition, users can automatically check spelling, seek and change the text by matching words or fonts, and apply smart punctuation, such as ligatures, quotation marks, and so on.

## 3. Layers Palette

The Layers palette lets users produce, remove, adjust, show, hide, lock, and move layers and choose options that affect how layers print. Layers help users manage elements in illustrations and isolate parts of a complex drawing to make edits more quickly.

## 4. Pathfinder Filters

Pathfinder filters make it possible to create objects instantly that would otherwise be challenging to create. Ten pathfinder filters create new objects by combining, subdividing, or isolating parts of overlapping objects.

## 5. Multiple Levels of Undo and Redo

Adobe Illustrator allows users to undo and redo up to 200 steps (the exact number of undo steps depends on the amount of RAM



available). Now users can change their minds or correct mistakes instantly.

#### 6. Adobe Illustrator Artwork Conversion to Bitmaps

Users can instantly convert any artwork they've created in Adobe Illustrator into raster images (also called bitmaps) at any resolution using any color space. They can then apply Photoshop-compatible filters to these raster images to instantly create effects that would be time-consuming or impossible to create by hand.

#### 7. Photoshop Filters

Users can apply any Adobe Photoshop plug-in filter or Adobe Photoshop-compatible filter to imported raster images or to rasterized artwork created in Adobe Illustrator. With these filters, users will be able to distort images, create impressionistic, mosaic, blurred, and further effects and to create a variety of dazzling effects.

#### 8. Built-In Color Separations

Adobe Illustrator includes a number of supporting features—such as the ability to trap objects, applies halftone screen rulings, and converts all colors to CMYK colors—that help ensure the highest-quality printed results.

#### 9. Align Palette

The Align palette allows customers to align selected objects along a vertical or horizontal axis using the bounding boxes of those objects.

Users can specify whether objects align vertically along the left, center, or right edge of the bounding box or horizontally along the top, center, or bottom edge of the bounding box.

#### 10. Transform Palette

The Transform palette shows information about selected objects, such as the width and height of the object or its location in relation to the x and y axis. Users can then enter values to precisely change the dimensions of the object or move it to a new location. The Transform palette also allows users to skew or rotate objects.

#### 11. Tools Palette

Tools palette provides standard tools and special plug-in tools for their user. Tools palette events such as a click on a sprite or the entry of the playback head into a frame. When the event arises, the behavior performs an action, such as skip to different frame or playing a sound. Although Director comes pre-installed with customizable, reusable behaviors for many basic functions but it also provides the user the facility to create their own behaviors through writing Lingo script. Other than that, the behaviors can also be modified.

#### 12. Movie Scripts

Movie scripts react to events such as key pressed and mouse clicks, and can control what happens when a movie begins, stops, or pauses. Handlers in a movie script can be called from other scripts in the movie as

### 4.3.5.3 Programming Language

#### Lingo Scripts

Lingo was the scripting language by Director. By using it, it can assist the user to include interactivity to a movie and to control a movie in response to a particular conditions and events. Director uses four types of scripts which are behaviors, movie scripts, parent scripts, and scripts attached to cast members. Behaviors, movie scripts, and parent scripts all appear as cast members in the Cast window.

#### **Lingo Scripts Features:**

##### 1. Behavior

A behavior is prewritten Lingo script that can be use to provide interactivity and include interesting effects to the movie. Most behaviors respond to simple events such as a click on a sprite or the entry of the playback head into a frame. When the event arises, the behavior performs an action, such as skip to a different frame or playing a sound. Although Director comes packaged with customizable, reusable behaviors for many basic functions but it also provide to the user the facility to create their own behaviors through writing Lingo script. Other than that, the behaviors can also be modified.

##### 2. Movie scripts

Movie scripts react to events such as key presses and mouse clicks, and can control what happens when a movie begins, stops, or pauses. Handlers in a movie script can be called from other scripts in the movie as



the movie plays. Movie scripts are available to the whole movie, regardless of which frame the movie is in or which sprites the user is interacting with.

### 3. Parent scripts

Parent scripts provide the advantages of object-oriented programming within Director. The advantages comprise the capability to write less code and use easier logic to carry out tasks in Lingo. It can also generate script objects that behave and react similarly but function independently of each other. Lingo can create unlimited multiple copies (or instances) of a User can enter scripts directly into the Actions panel. Tools and parent script and it is called a child object.

### 4. Scripts attached to cast members

Scripts attached to cast members are attached directly to a cast member, independent of the Score. Whenever the cast member is assigned to a sprite, the cast member's script is available. Unlike behaviors, movie scripts, and parent scripts, cast member scripts don't appear in the Cast window. However, if Show Cast Member Script Icons is selected in the Cast Window Preferences dialog box, cast members that have a script attached display a small script icon in the lower left corner of their thumbnails in the Cast window.

## ActionScripts

ActionScript is Flash's scripting language that can be use to control objects in Flash movies to create navigation and interactive elements and to extend Flash to create highly interactive movies and Web applications. Flash 5 ActionScript has many new features and syntax conventions that make it similar to the core JavaScript programming language.

### ActionScripts Features:

#### 1. Text editing

User can enter scripts directly into the Actions panel in Expert Mode and choose elements from a pop-up menu or a Toolbox list.

#### 2. Dot syntax

User can use dot syntax to get and set the properties and methods of an object, including movie clip instances and variables

#### 3. Data Types

Flash 5 ActionScript supports the following data types: string, number, boolean, object, and movie clip. Multiple data types allow user to use different types of information in ActionScript

#### 4. Local variables

User can declare local variables that expire at the end of the action list or function call. This allows users to manage memory and reuse variable names.

## 5. User-defined functions

User can define functions with parameters that return values. This allows user reusing blocks of code in their scripts.

## 6. Predefined Object

User can use predefined objects to access and manipulate certain types of information. The following are a few of the predefined objects:

- The Math object features a full complement of built-in mathematical constants and functions, such as `E` (Euler's constant), `cos` (Cosine), and `atan` (Arctangent).
- The Date object allows user to get information about the date and time on whatever system is running the Flash Player.
- The Sound object allows user to add sounds to a movie and control sounds in a movie as it plays. For example, user can adjust volume (`setVolume`), or balance (`setPan`).
- The Mouse object allows user to hide the standard cursor so that they can use a custom The MovieClip object allows user to control movie clips without using a wrapper action such as `tellTarget`. User can call a method such as `play`, `loadMovie`, or `duplicateMovieClip` from an instance name by using dot syntax (for example, `myMovieClip.play()).cursor`.



## 7. Clip actions

*onClipEvent* action can use to assign actions directly to movie clip instances on the Stage. The *onClipEvent* action has events such as *load*, *enterFrame*, *mouseMove*, and *data* that allow user to create new kinds of advanced interactivity.

## 8. New actions

New actions such as *do..while* and *for* can use to create complex loops. Other new actions are implemented as methods of the *MovieClip* object; for example, *getBounds*, *attachMovie*, *hitTest*, *swapDepths*, and *globalToLocal*.

## 9. Smart Clip

Smart Clips have internal scripts that user or another developer, can change without using the Actions panel. User can pass values to a Smart Clip through clip parameters that they can define in the Library.

## 10. Debugger


The Debugger allows user to view and change variable and property values in a movie playing in Test-movie mode, the stand-alone Flash Player, or a Web browser. This allows user to easily find problems in their ActionScript.

11. XML Support

The predefined XML object allows user to convert ActionScript to XML documents and pass them to server-side applications. User can also use the XML object to load XML documents into a Flash movie and interpret them. The predefined XMLSocket object allows user to create a continuous server connection to pass XML data for real-time applications.

University of Malaya

Table 5.1 : Data Flow Diagram Descriptions and Symbols

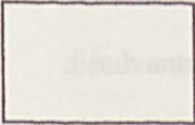

Symbols	Name	Description
	Entity	An external entity that can send data to or receive data from the system. Interacts with the system but considered as outside of the boundaries of the system.
	flow of data	It is used to show the movement of data from an origin to a destination with the head of arrow pointing towards the destination.

# CHAPTER 5: System Design


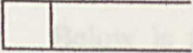
Design is the creative process of transforming the problem into a solution or the description of a solution. Software design can be viewed in the same way. To define the problem, the requirement specification will be used. The nature may change as the solution is described or implemented.

For FunMaths, Data Flow Diagram and structured charts will be used to model the system. To show the outline of the FunMaths system, I have chosen to use structured charts. Data flow diagram will be use to provide the graphical illustration which shows the flow of data and logic within the system. Data flow diagram comprise of four basic symbols as shown below.

Table 5.1 : Data Flow Diagram Description and Symbols

Symbols	Name	Description
	entity	An external entity that can send data to or receive data from the system. Interacts with the system but considered as outside of the boundaries of the system.
	flow of data	It is used to show the movement of data from an origin to a destination with the head of arrow pointing towards the destination



	process	It represents the transformation or processing of information within a system.
	data store	It shows the repository for data that allows addition or retrieval of data

## 5.1 Designing FunMaths

The design of FunMaths is based on all the information gathered from the research that I have conducted which I had explained it in Chapter 2 Literature Review. The content of the system is designed based on the requirements of the end-users and the interface is designed according to end users interest other than taking the requirement of the attractiveness as consideration. Other than that, to design the system, the advantages and disadvantages of the existing systems are taken into consideration.

Basically, these are the characteristic of FunMaths:

- User friendly
- Based on the Multimedia Interactive concept
- Instructions that are simple and easy to understand
- Games focused on mathematic operation such as addition, subtraction, multiplication and division
- Attractive interface
- Well organized and easy to navigate

- Will be developed in English and in every screen there will be instructions in the text form.

## 5.2 System Structural Design and DFD (Data Flow Diagram) for KidsHeaven

Below is the structured chart for my project, KidsHeaven. It shows the interaction and relation among the modules. Each and every module has their specific function and the combination of the module was the system.

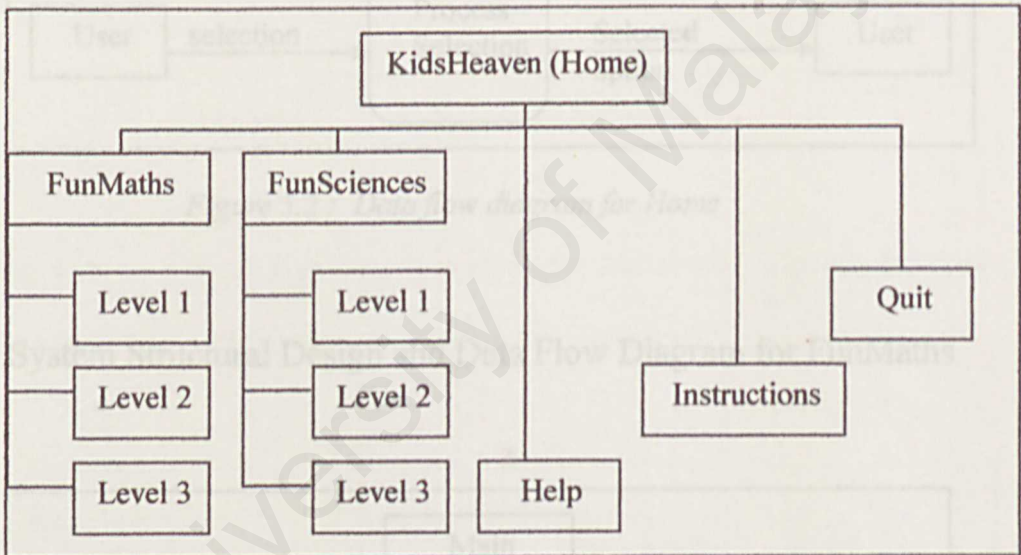


Figure 5.1: KidsHeaven structured chart

The figure above is a structured chart map that shows the structure of the “KidsHeaven” system. The system will be divided to two main modules, which are games based on mathematics (FunMaths) and the other was games based on sciences (FunSciences). The system will also provide help and instruction module. In each of the mathematics and sciences module, it will be divided into three levels where each level in the FunMaths and FunScience

represents different level of difficulties. As mention earlier, each level in FunMaths will have the different level of difficulty and it will give the user various types of questions to test their knowledge. The help function will guide the user on how to use the CD-ROM and also some guide on how to play the games and many more. Besides, the instruction also will provide the user on how to play the game. The quit button allow the user to quit or end the program anytime they want.

Below is the data flow diagram for the main menu (Home).

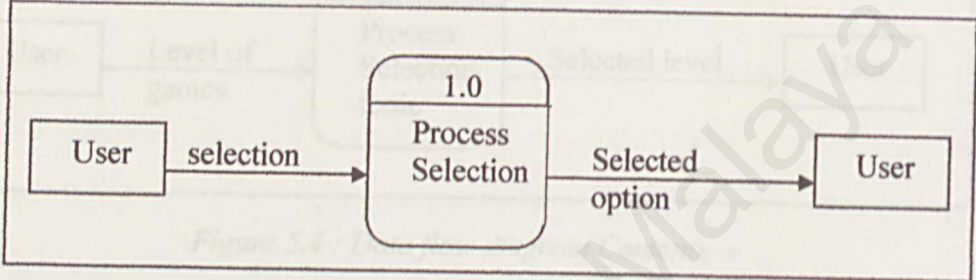


Figure 5.2 : Data flow diagram for Home

5.2.1 System Structural Design and Data Flow Diagram for FunMaths

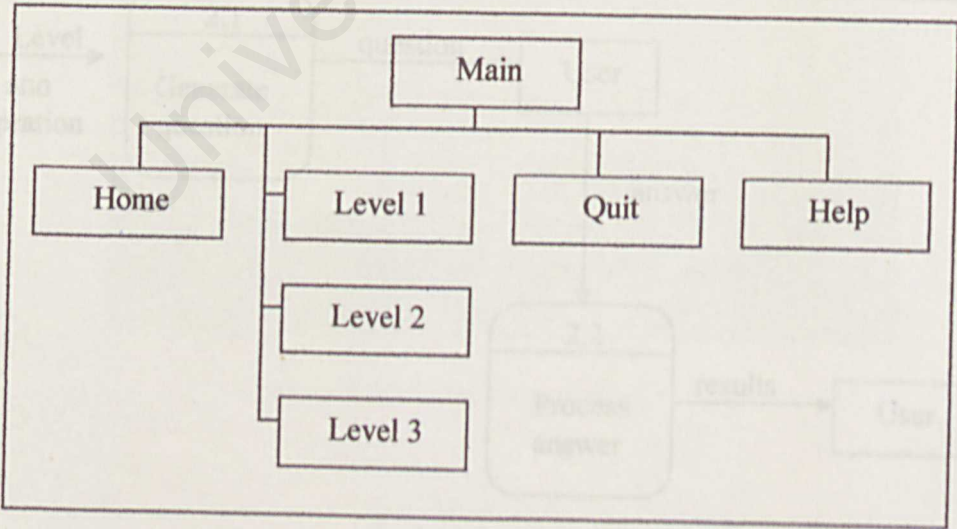


Figure 5.3 : Structured chart for FunMaths



As shown above, the FunMaths games will be divided into 3 levels which are based on the combination of the mathematic operation such as addition, subtraction, multiplication and division. When the user click on a certain level, the screen will be shown and the user can get the instructions on how to play on each of the level of game. Then, user will be able to start the game after they click on the operation that they would like to play.

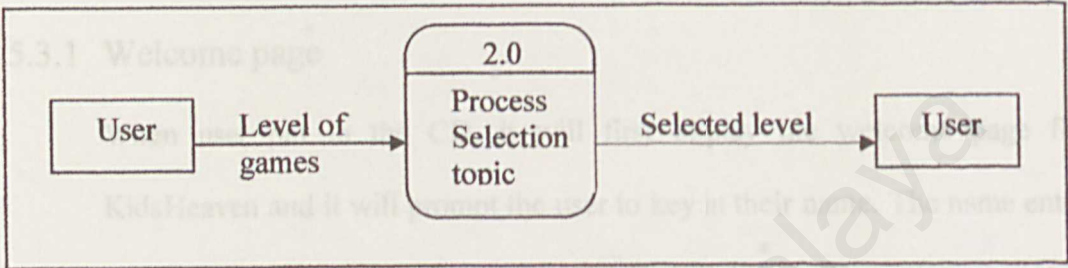


Figure 5.4 : Data flow diagram Contents

After the user selects the level and the operation, the system will process their selection and display it to the user according to their selection.

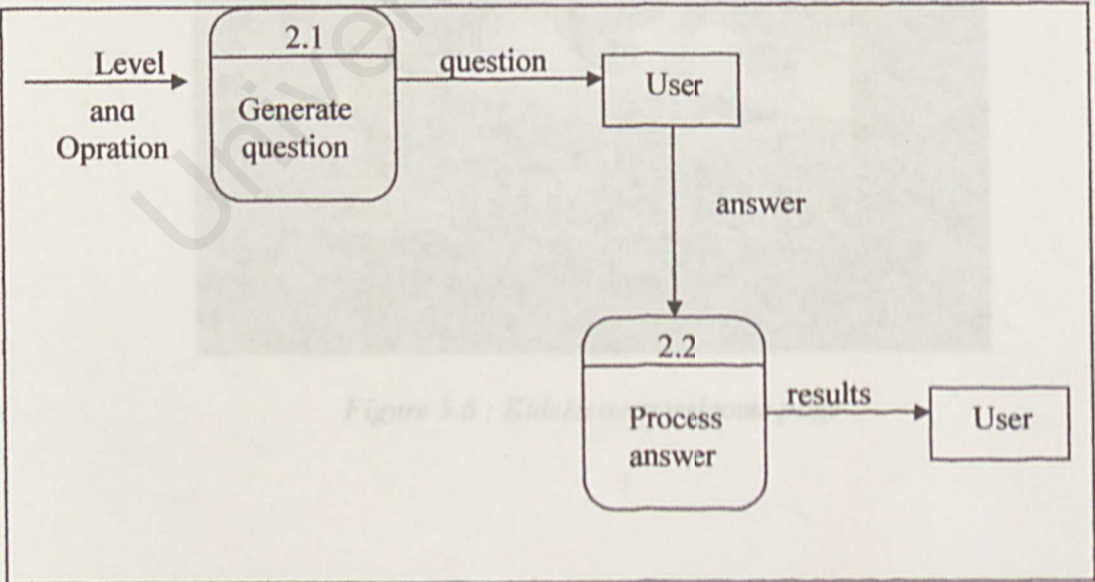


Figure 5.5 : Child diagram for process 2.0

## 5.3 User Interface Design

The whole user interface design will be interactive and selection of color and graphics will be taken into consideration. The interface will not be too compact and complicated till it might 'blur' the user when looking at it or navigating it and making the user feel comfortable when they use the system. Animations for some of the graphic and texts will be added to make the interface more lively and attractive.

### 5.3.1 Welcome page

When user put in the CD, it will first display the welcome page for KidsHeaven and it will prompt the user to key in their name. The name enter by the user will be capitalize for the first alphabet. Then user can start choosing the modules.



*Figure 5.6 : KidsHeaven welcome page*

### 5.3.2 Home

After user had key in their name, the ‘Home’ page will be display where it will display two main modules in this page. User can choose either to play FunMaths or FunScience by clicking on the “FunMaths” or “FunSciences” logo.

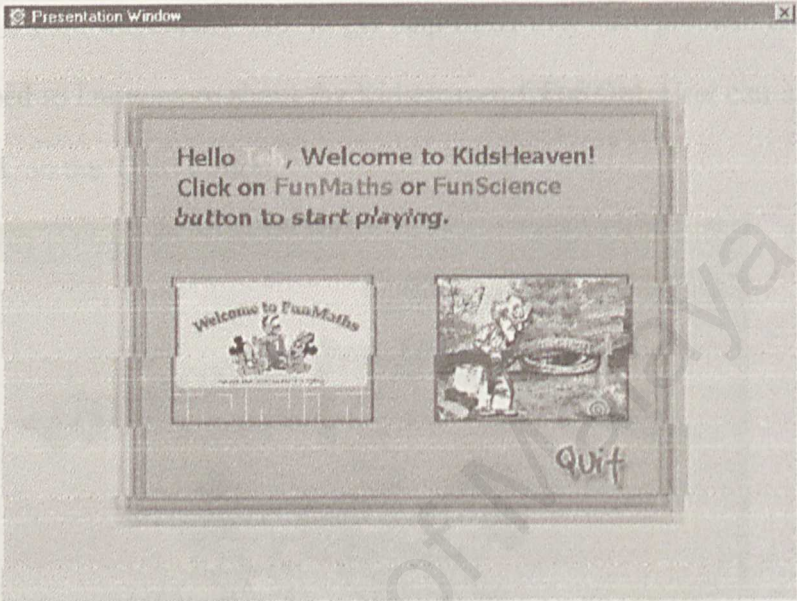


Figure 5.7 : KidsHeaven ‘Home’ page

Figure 5.8 : FunMaths's Main



5.3.3 Main

If user clicks on the FunMaths, it will link the user to the main page of FunMaths. In this screen, user can choose the level of game by click on the 'level' button. There are 'Home' button on the right top of this page that will enable the user to go back to 'Home' page and reselect the module. The 'Help' button will enable user to get help when they face problem and when they need to know more about the KidsHeaven CD-ROM. User can also quit by click on the 'Quit' button.



Figure 5.8 : FunMaths's Main

5.3.4 FunMaths-Level 1

If user clicks on the ‘Level 1’ button on the ‘Main’ page, it will display this screen to the user. In this level user will be tested on the question based on mathematic operation involving one digit. User will be able to choose the other level again by click on the level button on the top of the page and if user wants to play FunSciences, they just need to click on the ‘Home’ button.

In this level, users just need to drag the correct apple and drop it in the box near the basket.

After user had finish answering the question in this page, they can move to the next set of game by clicking on the operation button again. To motivate the user, there will be a ‘right’ symbol after they drag each apple correctly and if they put it in wrong position, the system will automatically put back the apple.

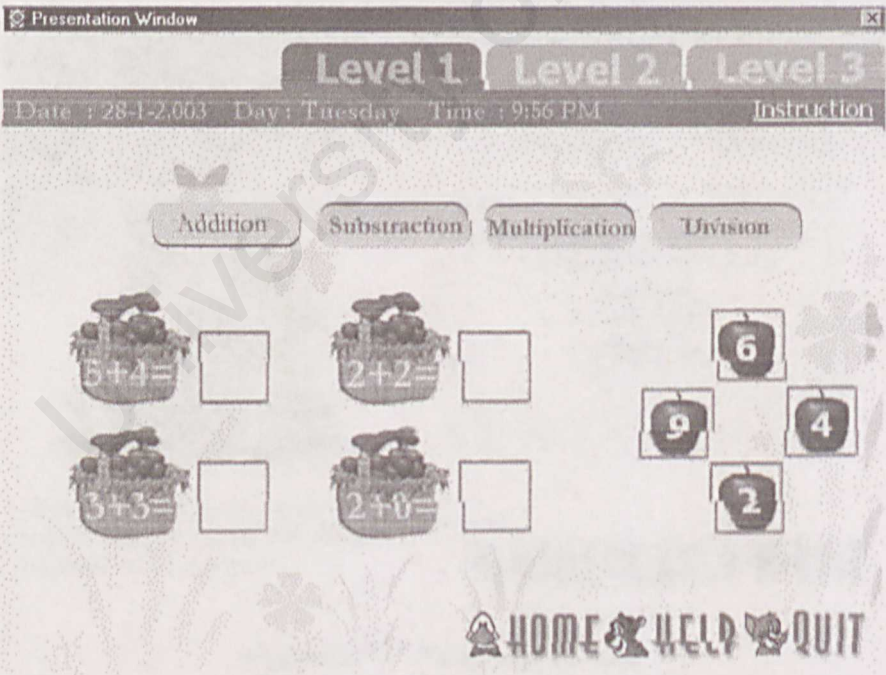


Figure 5.9 : FunMaths Level 1



5.3.5 FunMaths-Level 2

When user selects ‘Level 2’, this screen will be display. The buttons in the bottom will have the similar function as the buttons in Level 1 and Level 3. It has background music that is different from ‘Level 1’ and ‘Level 3’ and it will also link the user to the next page of this level when they finish the selected set of the game.

In this level, user will be tested on true or false question based on mathematic operation and it consists of questions that involve only two digits. They can move to the next question by clicking the purple background and start another new set of game by click the operation button. They will be scores shown at the end of each game.

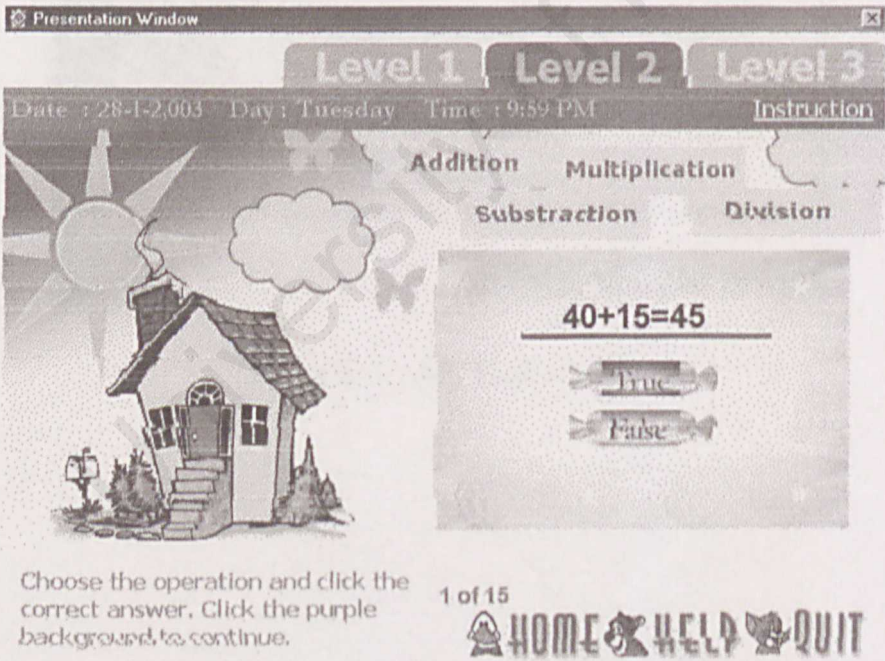


Figure 5.10 : FunMaths Level 2



5.3.6 FunMaths-Level 3

In this level, user will be tested on operations for three digits. User just need to key in the correct answer. If they answered it correctly, it will enable user to try the next question and if not, they can choose another set of question by click on the operation button.

There will be background music and some motivation message if the user did it correctly.

The button in the bottom is similar with other level.

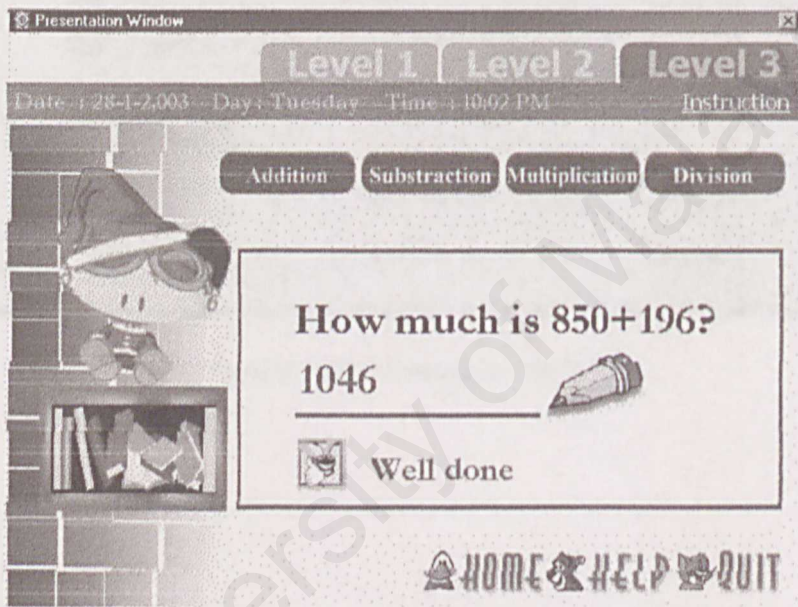


Figure 5.11 : FunMaths Level 3

5.3.7 Help

The ‘Help’ button in every page will link the user to this page. As I mentioned earlier, user can get help or information from this page.

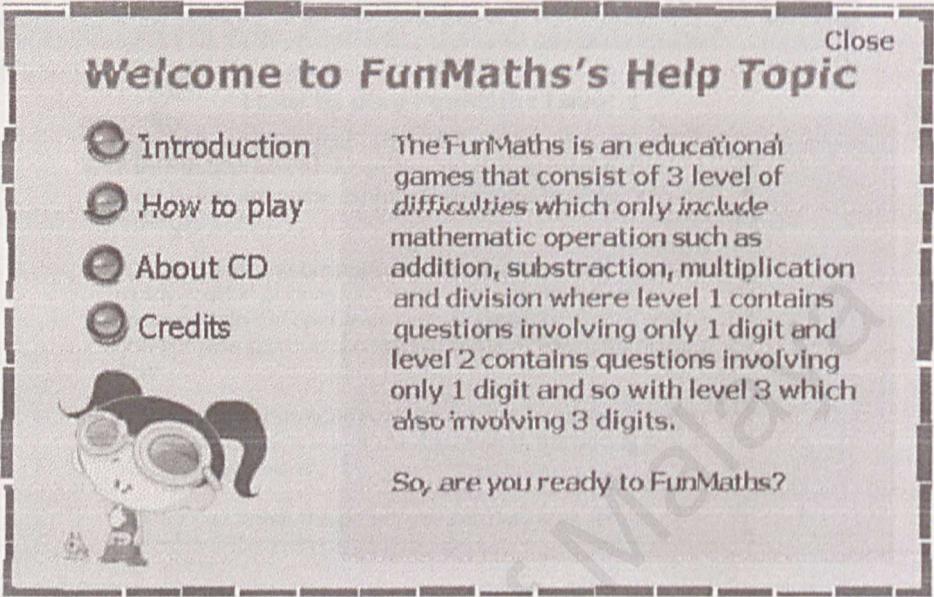


Figure 5.12 : FunMaths ‘Help’

5.3.9 Quit Confirmation

This message will be shown whenever the user quit the program. Before it quit, it will ask the user confirmation to quit.



Figure 5.14: FunMaths ‘Quit Confirmation’



### 5.3.8 Instructions

Below is the example of the instruction's page. It contains information about how to play and it did exist in every level.

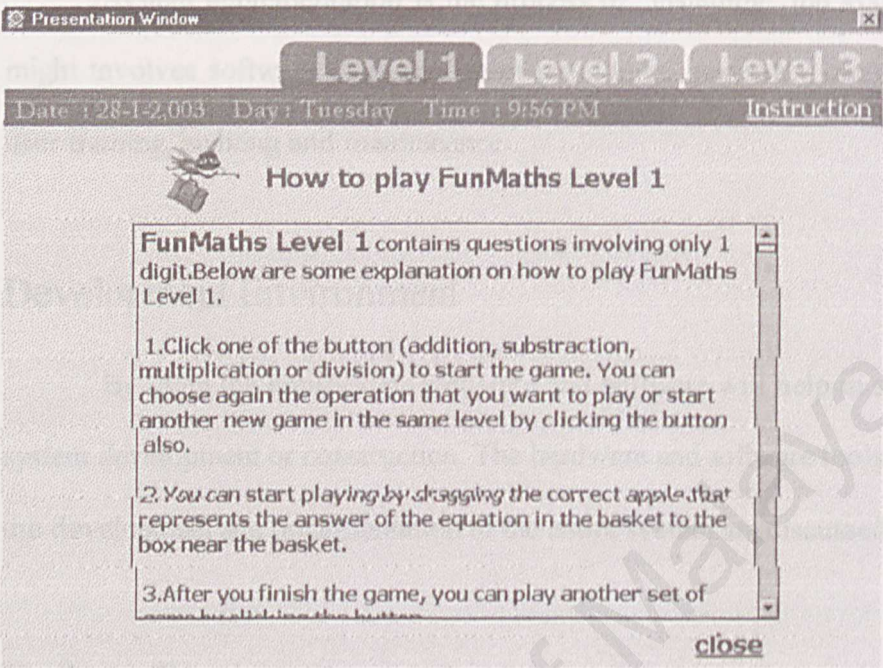


Figure 5.13 : FunMaths 'Instructions'

### 5.3.9 Quit Confirmation

This message will be shown whenever the user quit the program. Before it quit, it will ask for user confirmation to quit.

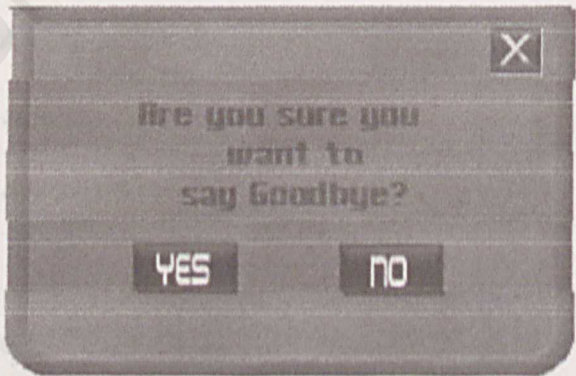


Figure 5.14 : FunMaths 'Quit Confirmation'



# CHAPTER 6: System Implementation

## 6.1 Introduction

System implementation is the process of "installing" the system that might involves software (and hardware) installation, necessary conversions, user training, auditing and maintenance.

## 6.2 Development Environment

By using the appropriate hardware and software will help in speed up system development or construction. The hardware and software tools used in the development and documentation of the entire system are discussed below:

### 6.2.1 Hardware Requirements

The overall hardware requirements for the development of this project include:

- Intel Pentium 3 66 Mhz processor running on Windows 98
- 192 MB RAM
- Color Monitor
- CD ROM Read and Write drive
- Display adapter
- 32 bits Sound card
- Speaker
- Keyboard
- Mouse
- Other standard desktop PC compliance

## 6.2.2 Software Tools Requirements

- Software tool for documentation and analysis
  - Microsoft Office 2000
- Software tool for development
  - Macromedia Authorware 6
  - Macromedia Flash 5
  - Adobe Photoshop 7
  - Adobe Illustrator 10
  - Sound Forge
  - Windows Sound Recorder

## 6.3 Development of “Interactive Multimedia Educational Games”

Developers are required to create a user-friendly and easy to navigate interface at the early stage of the development. It is easy to carry out the requirement during the development with the assisted software.

### 6.3.1 Macromedia Authorware 6

Almost all of the parts in “KidsHeaven” are done using Authorware 6. Although Authorware 6 provides Knowledge Objects, which includes Application and Quiz that will make the process of developing an application easier but I have chose to build my system using the icon-based authoring where different types of icons contain different types of objects, such as graphics, text, sound, digital movies, or a set of instructions. The arrangement

of icons forms the logic of a piece results to its structure or architecture. The logic of a piece gives the piece shape and makes it work a certain way.

### 6.3.2 Adobe Photoshop 7

Some of the graphics and icons (Gif or Jpeg format) are downloaded from Internet or other resources and some of the graphics are created using Adobe Photoshop 7. The graphics and icons created using Photoshop are natural and suitable for the appearances of child playing games. By using this software, images are easily edited and had result system to come out with a standard layout where user will familiar in it.

### 6.3.3 Sound Forge

It is use as tools for sound editing so that the audio file that is being use is synchronize with the flow of the system.

## 6.4 Coding being used

Below is frequently use code that is used in developing this game:

### **Capitalize**

```
resultString := Capitalize("string!" [, 1])
```

Capitalize returns the string that results from capitalizing the first character of every word in string. This function had been applied to the page where user sign in their name and the name display in the main page will be capitalized in every word they enter.



## Go To Selected Icons

*GoTo(IconID@"IconTitle")*

When Authorware encounters a GoTo function, it jumps to the icon specify in IconTitle and continues its presentation from that icon.

## IF function

### Display Time, Day and Date

*Date : Day-Month-Year   Day : DayName   Time : Time   FALSE*

This is use to display the user's computer time in the page of each level.

## Page count

### Jump To Selected Files

*JumpFile("filename"[, "variable1, variable2, ...", ["folder"]])*

JumpFile causes Authorware to jump to the file that is specify in filename.

The presentation continues from that file. Packaged Authorware files can jump only to other packaged files.

It is part of the functions used in creating a quit confirmation message box.

### Randomly generate numbers

*number := Random(min, max, units)*

Random returns a random number between min and max in multiples of units.

Below are the examples of the function use in my system:

*rand1 := Random(501, 999, 1)*

*rand2 := Random(100, 500, 1)*

## Restart

### Round the numbers

*number := Round(x [, decimals])*

all variables, even if the file is set to Resume in the File Properties dialog box

Round rounds x to the number of digits specify (in decimals) to the right of the decimal point and returns the number. This was applied in level 3 for the division operation.

### **If function**

Below are the example of if functions use in FunMaths

if NumEntry = rand1 - rand2 then right := TRUE else right := FALSE

### **Page count**

*RepCount@"questions1 " of PathCount@"questions1 "*

This function displays the page number. It is use in level 2.

### **Quit**

*Quit (option)*

It is part of the functions use in creating a quit confirmation message box.

### **Quit Restart**

*QuitRestart(option)*

QuitRestart immediately exits the file. Upon restarting, Authorware sets all variables to their initial values.










### **Restart**

*Restart()*

Restart causes Authorware to branch to the beginning of the file and initialize all variables, even if the file is set to Resume in the File Properties dialog box.

## 6.6 Icon that is being used in authoring

The following table describes what each icon does:

 Display icon	Displays text and graphics on the screen. This is used in creating the background of the system.
 Erase icon	Erases any or all objects from the screen when they are no longer needed. This is used to erase any unwanted images to avoid overlapping among pages.
 Wait icon	It let users to decide when to continue. When using this the 'continue' button will be display.
 Decision icon	Sets up various paths Authorware can take depending on conditions and events. By using this, it enables me to develop the games where the question are randomly display.
 Interaction icon	It provides a variety of ways to make choices, such as clicking buttons or hot spots.
 Calculation icon	Updates values in variables. Executes functions that affect what the piece does.
 Map icon	Simplifies and organizes the flowline by grouping it into smaller segments.
 Sound icon	Includes music, narration, or sound effects in a piece.
 Start and stop flags	Speed up development by letting you test segments of the flowline as you create them.



# CHAPTER 7: System Testing

## 7.1 Introduction

The testing that includes examining the project performance according to the specifications that have been agreed was done according to the level-by-level basis beginning with the separate units and then finally the overall combined units were tested. This will include the robustness of the code or compatibility across different browsers, the structure and content of the program, the interface, the interactivity, the performance of the program, the look and feel.

## 7.2 Unit Testing

Unit testing is the test that is performed on individual module in the subsystem and involves the activities to control errors on each module. Testing was done on the functions, which is the basic component in the system. When a module was completed, it is tested to make sure the attached requirements are actually implemented by that module. All the links and buttons were tested to ensure that they bring users to the destination page.

Other than that the output of the system has also been checked by selecting different input to make sure that the answer for the question provided was correct and free of error. The smooth transition and reliability of the program had also been test

## 7.5 User Testing

The testing was conducted to determine the effectiveness of this system in helping students in improving their mathematics and in examining whether the user learns from the system. Other than that it was done to determine whether it meets the objective of the system development and to determine whether the design and the use of the color combination was attractive.

## 7.6 Maintenance

Maintenance is the process of modification and perfection of the system where the perfection of the system is in terms of adding additional functions to the modules of the fully functional system being used by the users. The perfection stage has not been done on this package, as it has not been used by the users. However for future enhancement this should be taken into consideration

## 7.7 Conclusion

All the necessary details of implementation and testing strategies for this package have been included here for better understanding of the package. This package was developed according to the analysis done so that all the requirements are met and match to the users needs.

# CHAPTER 8: System Evaluation

## 8.1 User Evaluation

From the user testing that had been conduct by me which involves teachers, primary students and university or college students, bellow is the summary of the overall survey.

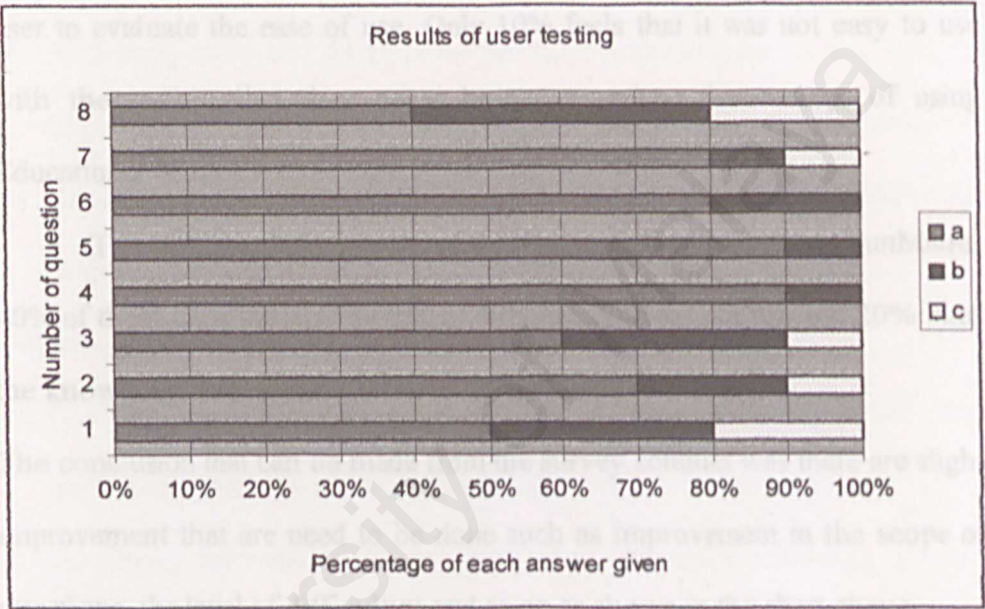


Figure 8.1: Charts of user testing results

Please refer to the question of this user evaluation that was attached in the appendix.

From the testing conducted, it shows that 50% of the user feels that the scope of the question is suitable and 30 % feels that it is moderate. For the level of difficulties, 70% feels that it is suitable and 10% feels that it was unsuitable while the rest feels that it is moderate.

When they were ask about the effectiveness of this game for learning, 60% feels that it is effective, 30% feels that it is moderate and the rest feels



that it is not effective. For the combination of colors, 90% feels that it is attractive while the others feel not and for the next evaluation was regarding the design for the interface get the same percentage as the result for color combination.

The next question was about the ease to navigate. From the evaluation, 80% feels that it is easy to navigate while 20% feels that it is moderate. Other than asking about the ease to use, I also provide the question which let the user to evaluate the ease of use. Only 10% feels that it was not easy to use with the reasons that they never been exposed to the concept of using Educational Games.

The last question was related to their overall opinion about FunMaths. 40% of them likes the user interface, 40% likes the ease of use and 20% likes the knowledge that is gain.

The conclusion that can be made from the survey conduct was there are slight improvement that are need to be done such as improvement in the scope of questions, the level of difficulties and so on as shown in the chart above.

## 8.2 Project Problems and Solutions

There are several problems encountered throughout the process of developing the “Interactive Multimedia Educational Games (FunMaths)”. Below are some of the problems that we face and the way we solve the problem during project analysis and development.

### 8.2.1 Problems and Solutions encountered during projects studies and analysis

The “Interactive Multimedia Educational Games” is a Multimedia based project, which acquires the use of all Multimedia elements such as images, graphics, audio, animation and text integrated in it.

**Problems:**

1. The main problem during project studies and analysis is choosing the suitable platform and software for developing this project.
2. Choosing the appropriate development life circle model and methodology.
3. Finding facts and methods of application with regards to the design of the project either logically or physically and technically.

**Solutions:**

1. Refer on relevant materials such as books, journals from library and try to understand them.
2. Retrieving information from the Internet and make a through analysis with regards to the mentioned problems.
3. Refer to the previous projects that done by senior students in the Bilik Dokumen of FSKTM.
4. Supervision of supervisor and moderator and also course mate’s advice and guidance.

**Solutions:**

1. To solve our problem when using the software, we had gain the appropriate assistance from the Help menu that come with the software to

## 8.2.2 Problems and Solutions encountered during projects implementation and testing.

### ***Problems:***

1. Without the knowledge of using Macromedia Authorware 6, we have to learn by ourselves to use the Macromedia Authorware 6, Macromedia Flash 5 and also Adobe Photoshop 7. Other than that we also face the problem where we cannot find any other help from other source other than depends only on materials from the internet and also books in order to master the software.
2. Choosing the appropriate images and icons for interface that are suitable for children is one of the tough process in developing an educational games where we have to consider many factors before we decide on what to include in the design such as the suitability for the game and the objective of the system.
3. After deciding on which images and icons to use, we also face a slight problem in designing the suitable and attractive layout for our game.
4. To make our game more interactive, we have include several Flash files in our system and we also face difficulties in integrating the files into our project.
5. Testing the entire system at another computer and different platform is another problem that we face.

### ***Solutions:***

1. To solve our problem when using the software, we had gain the appropriate assistant from the Help menu that come with the software to



1. understand how to use the particular software and mastering in the software to enable us to use all of the functions provide by the software.
2. Reference from other projects done previously by senior and software that are available in market did help us in dealing with the problem.
3. By viewing the tool tips and the Help menu found from the Internet, we manage to solve parts of our problem such as what type of design that suits our target user.
4. Some of the features or links cannot be presented properly when testing is done on another computer. Therefore some changes need to be done to make sure that all the features are presented well.

### 8.3 System Strength

Below are my system strengths:

1. The system that I build did have the features such as attractive and interactive user interface that will enable the users to get familiar on it.
2. The CD for FunMaths was been made to run automatically after they insert the CD.
3. Links and navigation are easy to follow through the use of meaningful and recognizable icons and buttons.
4. English Language as a delivery language due to teaching of Science and Mathematics in English is confined to Year One, Form One and Lower Six this year.
5. Audio narration to increase understandability of the particular component and increase the study mood such as the use of background music.

6. Users can exit the system and link to main screen at anytime without the need to finish the game.
7. The Instructions file that was provided in most of the pages let the users to refer on how to play the games on the level that they chose. Other than that they also can refer to the instruction of other games or other help information from the help file provided.
8. There are some roll over button that had been use to let the user knows that the button is clickable.
9. All the questions in every level were random.
10. For level 1 if the user gives the wrong answer, the apples will be put back to its original location and this will tell them to try again to get the correct answer.
11. For level 2, if the user fails to give the correct answer, the immediate feedback together with the questions and the correct answer that they get it wrongly will be shown.
12. For level 3, the number of questions was infinite as I have applied the random function on it where the numbers are randomly generated.
13. There are times, day and date shown in almost every page.

## 8.4 System Weakness

Below are my system weaknesses:

1. The characters in each game are not standardized.
2. Users are not able to keep track of their score or game had been played when they enter to this system again because there is no database provided to store user information in the system.

3. There are no search functions provided in the Help file.
4. There are limited questions for level 1 and level 2. This will make the user feel bored when they play frequently.
5. The game for each operation in the same level is the same.

## 8.5 Future Enhancements

Below are the futures enhancements that is need to develop a better educational games:

1. Make user to be able to keep track of their score or games that they had played when they play this games again by providing database to store user information in the system.
2. Standardized the layout so that it looks more professional.
3. Add a search function in the Help file.
4. More games are added so that user will not be easily get bored.

## 8.6 Suggestions for course improvement

1. Provide more sources in the Bilik Dokumen so that students are able to do research.
2. Equip more the computer with CD writer so that students are able to save large files that are related to their project easily.

## 8.7 Conclusion

Finally, the “Interactive Multimedia Educational Games” has been reaching its end stage. Fortunately this system is completed on time and can



be integrated successfully with FunScience that had been done by my teammate. Most of the requirements, which have been defined in the scope of this project, have been achieved.

Teamwork, time management and the communication skill are three key factors that lead us to the success of the project. Throughout this project, there are more enhancements on our project development skills, so as our project management skills. However we also realize that more improvement that need to be done.

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<http://cee.indiana.edu/publications/multipres/MM.html>

<http://snow.utoronto.ca/cat/webcourse/day4/4-3.html>

[http://quizhub.com/quiz/f\\_multiplication.cfm](http://quizhub.com/quiz/f_multiplication.cfm)

<http://hotwired.lycos.com/webmonkey>

[http://www.epsys.com.sg/epsys\\_white\\_paper\\_implementing\\_cd\\_soln.htm](http://www.epsys.com.sg/epsys_white_paper_implementing_cd_soln.htm)

<http://www.sims.berkeley.edu/~hearst/irbook/10/node3.html>

[www.janetandjohn.com](http://www.janetandjohn.com)

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[www.funschools.com](http://www.funschools.com)

[www.kidsdomain.com](http://www.kidsdomain.com)

[www.school.discovery.com](http://www.school.discovery.com)

[www.crpuzzle.com](http://www.crpuzzle.com)

[www.learningplanet.com](http://www.learningplanet.com)

[www.webpedia.com](http://www.webpedia.com)

[www.321clipart.com](http://www.321clipart.com)

[www.grsites.com](http://www.grsites.com)

[www.kidsolr.com](http://www.kidsolr.com)

[www.e-clipart.com](http://www.e-clipart.com)

## User Evaluation

### Objective

- To determine the effectiveness and attractiveness of this educational games and to determine if it meets the users' need and expectation.
- To determine whether this game met the objective of development.

Please kindly spend your time to fill in this form. Your cooperation will be highly appreciated.

User's details:

Standard: Primary school student/teachers/University or college student

## User Evaluation

1. What is your opinion about the level of difficulties in this game?  
a) Suitable  
b) Moderate  
c) Not suitable
2. Is the level of difficulties is appropriate for the stated age/grade level?  
a) Suitable  
b) Moderate  
c) Not suitable
3. How do you feel about the effectiveness of this games for learning?  
a) Effective  
b) Moderate  
c) Not effective
4. How you feel about the combination of colours that it being use in this game?  
a) Attractive  
b) Moderate  
c) Not attractive



# User Evaluation

## Objective:

- To determine the effectiveness and attractiveness of this educational games and to determine if it meets the users' need and expectation.
- To determine whether this game meet the objective of development

Please kindly spend some time to complete this survey. Your cooperation will be highly appreciated.

User's details:

Standard: Primary school student/teachers/University or college student

1. What is your opinion about the scope of the questions this game?
  - a) Suitable
  - b) Moderate
  - c) Not suitable
2. Is the level of difficulties is appropriate for the stated age/grade level?
  - a) Suitable
  - b) Moderate
  - c) Not suitable
3. How do you feel about the effectiveness of this game for learning?
  - a) Effective
  - b) Moderate
  - c) Not effective
4. How you feel about the combination of colours that is being use in this game?
  - a) Attractive
  - b) Moderate
  - c) Not attractive

5. Is the design for this game attractive?
- a) Attractive
  - b) Moderate
  - c) Not attractive
6. Do you feel that it is very easy to navigate in this game?
- a) Agree
  - b) Moderate
  - c) Not agree
7. Do you agree that user will be able to use the program independently?
- a) Agree
  - b) Moderate
  - c) Not agree
8. What is the things that you like in this game?
- a) User interface
  - b) Ease of use
  - c) Knowledge gain
- If others, please specify \_\_\_\_\_

Prepared by

Teh Sok Hoon

WET000038

## HARDWARE AND SYSTEM REQUIREMENTS

### Windows®

Runs on: Pentium 366 MHz or faster

With:

- Minimum 8 MB
- Hard disk with 500 MB of free disk space
- 8X or faster CD-ROM drive
- 16-bit color monitor capable of 640x480 resolution
- Windows 95, 98, Me, 2000, or XP
- Windows-compatible keyboard
- Windows-compatible mouse

# Appendix B

# User Manual

University of Malaya



## HARDWARE AND SYSTEM REQUIREMENTS

### Windows®

Runs on: Pentium 366 MHz or faster

With:

- Minimum 8 MB of memory (RAM)
- Hard disk with 500 MB of free disk space
- 8X or faster CD-ROM drive
- 16-bit color monitor capable of 640x480 resolutions
- Windows 95, 98, Me, 2000, or XP
- Windows-compatible sound card
- Windows-compatible mouse

## GETTING STARTED

FunMaths runs from your CD-ROM drive and FunMaths do not need any program to be installed in any computer. It will run automatically and retrieve all the contents from the CD.

## STARTING THE PROGRAM

FunMaths CD is an AutoPlay after you insert the CD and found that the AutoPlay did not functioning or you can't get into FunMaths,

1. Try to insert the FunMaths CD in your CD-ROM drive again or
2. Double-click **My Computer**.
3. Double-click the CD-ROM icon.
4. Double-click **KidsHeaven.exe**.

## FUNMATHS

### Introduction

The FunMaths is an educational games that consist of 3 level of difficulties which only include mathematic operation such as addition, subtraction, multiplication and division where level 1 contains questions involving only 1 digit and level 2 contains questions involving only 2 digits and so with level 3 which also involving 3 digits.

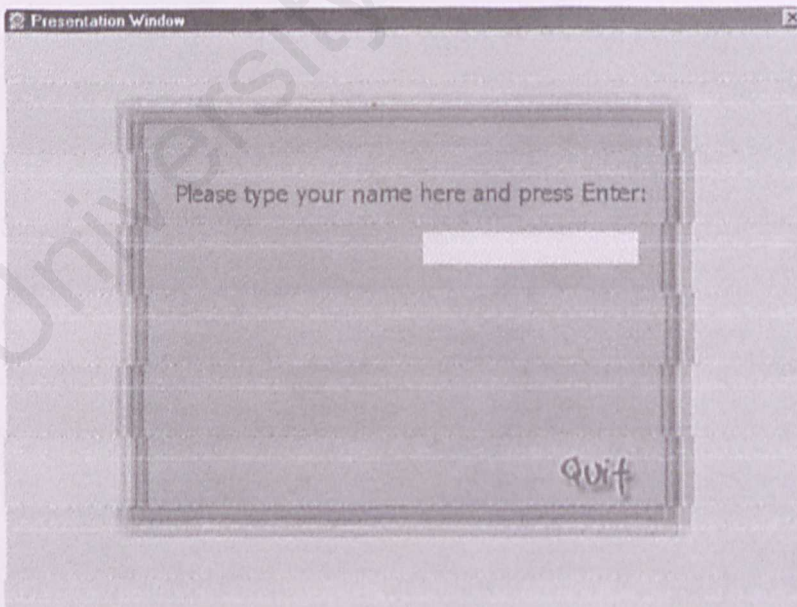
## Playing FunMaths

### Welcome page

After you put in the CD with the AutoPlay function working well, it will first display the welcome page for KidsHeaven. and it will prompt for your name.



*KidsHeaven welcome page*



*Sign-in page*

When you are in the sign in page, you can click quit if you would like to quit the program. After sign in your name, please press 'enter'.



Home

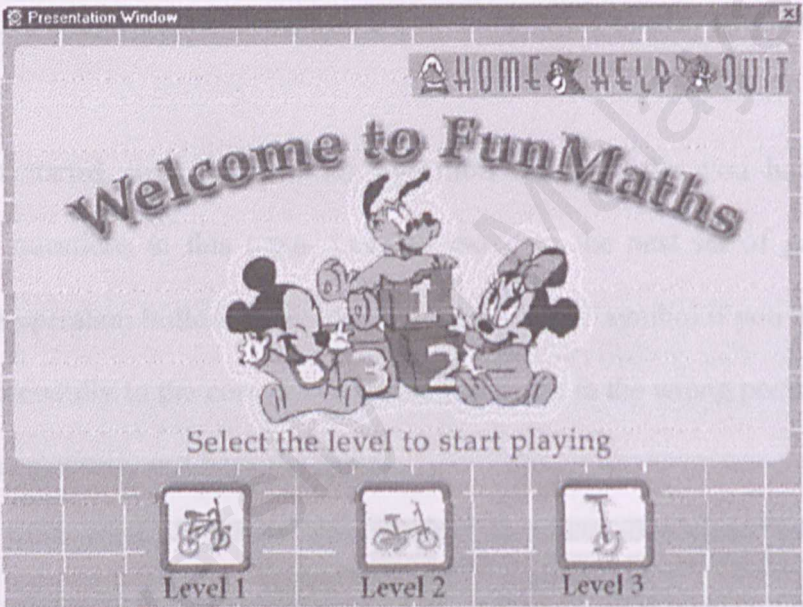
After key in your name, the 'Home' page will be display where it will display two main modules in this page. You can choose either to play FunMaths or FunScience by clicking on the "FunMaths" or "FunSciences" logo.



*KidsHeaven 'Home' page*

**Main**

If you clicks on the FunMaths, it will link you to the main page of FunMaths. In this screen, you can choose the level of game by click on the 'level' button. There are 'Home' button on the right top of this page that will enable you to go back to 'Home' page and reselect the module. The 'Help' button will provide you with the help information when you face problem or when you need to know more about the KidsHeaven CD-ROM or any other related information. You can also quit by click on the 'Quit' button.



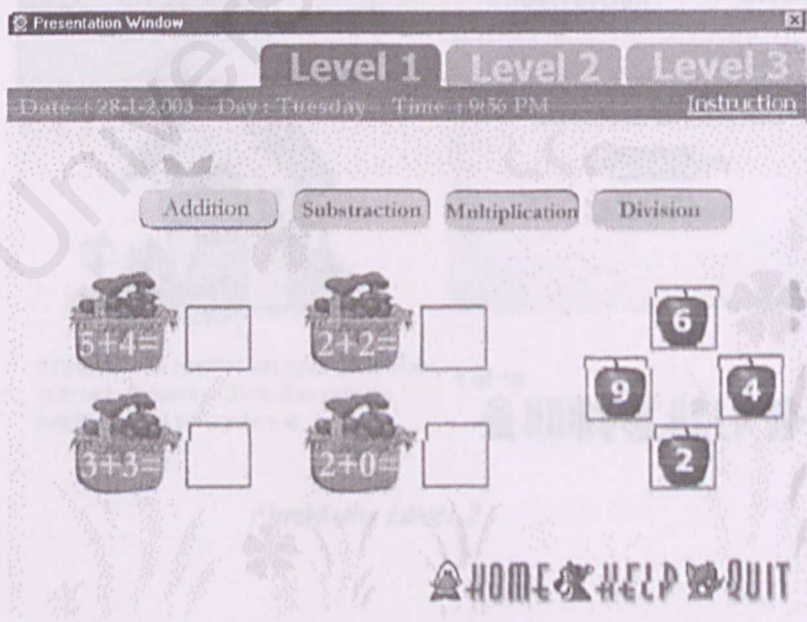
*FunMaths's Main*

FunMaths-Level 1

If you click on the 'Level 1' button on the 'Main' page, this screen will be display. In this level the question will be based on mathematic operation involving only one digit. You will be able to choose the other level again by click on the level button on the top of the page and if you want to play FunSciences, just click on the 'Home' button.

In this level, you just need to drag the correct apple and drop it in the box near the basket. To know more about the instruction on how to play the game, click on the instruction button and close the instruction that is being display by click on the close button.

To get started, just click on the operation button. After you had finish answering the questions in this page, you can move to the next set of game by clicking on the operation button again. There will be a 'right' symbol if you had drag each apple successfully to the correct box and if you put it in the wrong position, the system will automatically put back the apple.



FunMaths Level 1

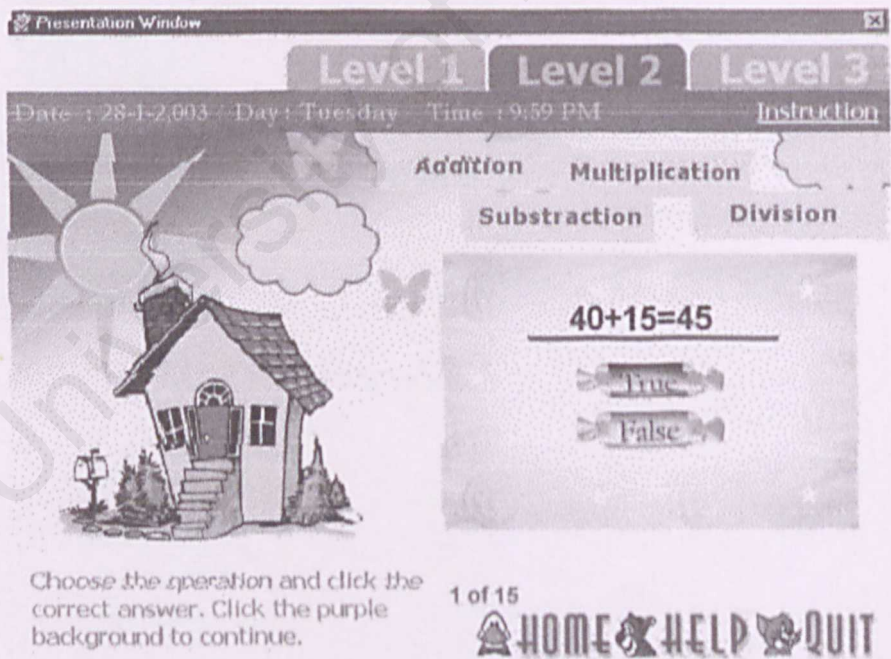


## FunMaths-Level 2

The buttons in the bottom of the page have the similar function as the buttons in Level 1 and Level 3. It has background music that is different from 'Level 1' and 'Level 3' and it will also link the user to the next page of this level when they finish the selected set of the game. Each set of games consist of 15 questions.

The 'Quit', 'Help', 'Instruction' and 'Home' button has the similar function as the buttons in Level 1.

In this level, you will be tested on true or false question based on mathematic operation and it consists of questions that involve only two digits. You can move to the next question by clicking the purple background and start another new set of game by click the operation button. They will be scores shown at the end of each game.



FunMaths Level 2

FunMaths-Level 2

Level 1 Level 2 Level 3

Date : 29-1-2003 Day : Wednesday Time : 7:11 AM Instruction

**Quiz Results:**  
 You gave 8 correct responses, which is 53 % correct.

You should practice more in calculation.

15 of 15

Continue

### FunMaths Level 2 Score Window

After you had review your scores, click on the continue button to return to the game.

How much is  $850 + 1967$

1046

all done

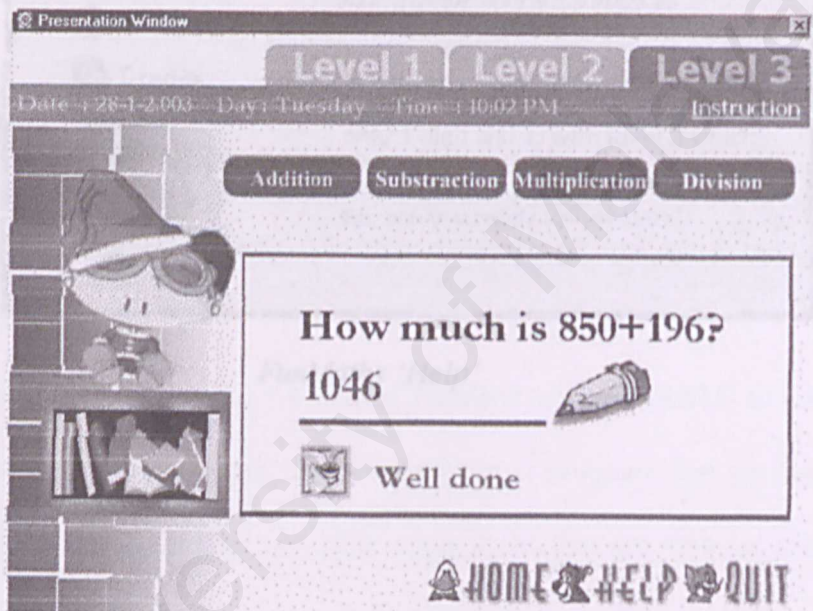
FunMaths Level 3

### FunMaths-Level 3

In this level, user will be tested on operations for three digits. User just need to key in the correct answer. If they answered it correctly, it will enable user to try the next question and if not, they can choose another set of question by click on the operation button.

There will be background music and some motivation message if the user did it correctly.

The button in the bottom and top of the page is similar with other level.

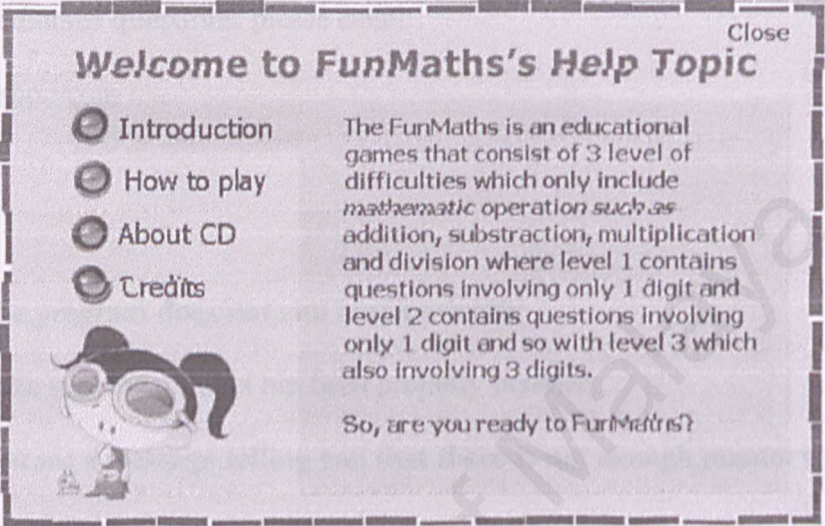


FunMaths Level 3



Help

The 'Help' button in every page will link the user to this page. As I mentioned earlier, user can get help or information from this page. Click on close to close this window.



FunMaths 'Help'

## TROUBLESHOOTING

Try this first! If you have problems running the program, try cleaning the CD.

Gently remove any fingerprints and dust using a clean, soft, lint-free cloth dampened with water or a CD-cleaning solution. Avoid using materials that may scratch the CD, such as tissue.

If you have additional questions, please email:

[yunel802@yahoo.com](mailto:yunel802@yahoo.com)

### Windows®

**1. The program does not run automatically**

Make sure the product has been properly inserted.

**2. You see a message telling you that there is not enough memory to run the program.**

FunMaths needs at least 8 MB of installed memory (RAM) to run. Your computer's memory may be filled with other programs that are running in the background. Close any other applications that are running, and restart the program.

**3. The mouse doesn't seem to work.**

There are times in the program when the animation or sound cannot be interrupted. Check that the mouse is properly connected to the computer or wait until the animation or sound stops and your normal cursor returns. Then try pressing the keys or clicking the mouse again.

**4. The program's speed is very slow.**

FunMaths needs at least a Pentium 366-MHz computer with a 8X CD-ROM drive for basic performance.

- Close any other applications that are running.
- Make sure that you have the latest Windows video drivers for your graphics card. (Contact the video card manufacturer for the latest drivers.)
- Change your display adapter settings to 640x480, 32-bit color display mode.

#### **5. You do not hear music, sound, or speech.**

- Check that the speakers are properly connected to your computer. Make sure that they are getting power and are turned on, and that the volume is turned up.
- Make sure that your sound card is Windows-compatible and is properly installed for Windows. Make sure that the sound card is specifically designed to work with the version of Windows that you are using.
- Make sure the volume is properly set. See the manufacturer's documentation for information relating to your sound card.
- Make sure you have the latest Windows video drivers installed. (Contact your video card manufacturer for more information.)
- Remove any non-essential applications from your Startup folder.

#### **6. Colors don't look right.**

- Adjust your monitor's color and brightness.
- Make sure your color display is set to 32-bit.
- Turn off your screensaver.
- Close any other applications that are running.



- Make sure you have the latest graphics drivers installed. (Contact your video card manufacturer for more information.)

**7. The program window seems small.**

- The program window may not fill the entire screen.
- For maximum window size, make sure the display mode is set to 640x480 (See your Windows documentation.)

## CONTACTING THE DEVELOPER

If you continue to experience problems, please kindly email to [yune1802@yahoo.com](mailto:yune1802@yahoo.com) and I would be glad if you provide the following information your contact information (name, e-mail address, phone number, and mailing address) and description of the problem

## CREDITS

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